

# **STORMWATER ANALYSIS & CALCULATIONS**

for

**1021 & 1025 MASSACHUSETTS AVENUE  
ARLINGTON, MASSACHUSETTS**

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# Checklist for Stormwater Report

## A. Introduction

**Important:** When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.<sup>1</sup> This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8<sup>2</sup>
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

<sup>1</sup> The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

<sup>2</sup> For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



# Checklist for Stormwater Report

## B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

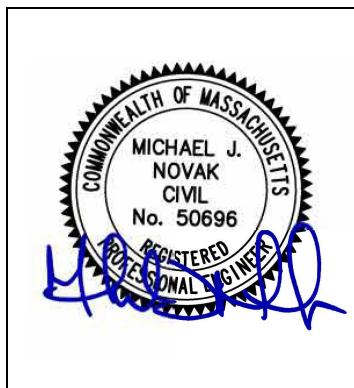
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

### Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



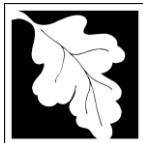
04-14-2023

Signature and Date

### Checklist

**Project Type:** Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



# Checklist for Stormwater Report

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## Checklist (continued)

**LID Measures:** Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
  - Credit 1
  - Credit 2
  - Credit 3
- Use of "country drainage" versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- Other (describe): \_\_\_\_\_

### Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

### Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
  - Static
  - Simple Dynamic
  - Dynamic Field<sup>1</sup>
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
  - Site is comprised solely of C and D soils and/or bedrock at the land surface
  - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
  - Solid Waste Landfill pursuant to 310 CMR 19.000
  - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

### Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
- Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
  - is within the Zone II or Interim Wellhead Protection Area
  - is near or to other critical areas
  - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
  - involves runoff from land uses with higher potential pollutant loads.
- The Required Water Quality Volume is reduced through use of the LID site Design Credits.
- Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
  - The ½" or 1" Water Quality Volume or
  - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the proprietary BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

### Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

### Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- Limited Project
- Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- Bike Path and/or Foot Path
- Redevelopment Project
- Redevelopment portion of mix of new and redevelopment.

Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



# Checklist for Stormwater Report

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## Checklist (continued)

### Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

### Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
  - Name of the stormwater management system owners;
  - Party responsible for operation and maintenance;
  - Schedule for implementation of routine and non-routine maintenance tasks;
  - Plan showing the location of all stormwater BMPs maintenance access areas;
  - Description and delineation of public safety features;
  - Estimated operation and maintenance budget; and
  - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
  - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
  - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

### Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

## **Stormwater Management Standards**

### **Project Narrative:**

The project site is comprised of two mixed-use lots located within the Neighborhood Office (B-1) District. The parcels are identified on the Town of Arlington Assessor's Map 55-2 as Lots 19 and 20. The subject properties have a total area of 47,085 s.f., and site features currently existing include two mixed-use dwellings, bituminous concrete driveways with parking lots, gravel areas, walkways, grassed/landscaped areas and wooded areas.

The applicant is proposing to construct a multi-story Chapter 40B development consisting of a multi-family dwellings (with an interior parking garage) and ground level retail space, along with a plaza, grassed and landscaped areas.

This proposal utilizes conventional stormwater management techniques including a subsurface infiltration system for the treatment and mitigation of stormwater.

The following is a summary of how the proposed project meets the DEP Stormwater Standards:

**Standard 1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.**

There are no untreated stormwater conveyances proposed to discharge to wetlands or waters of the Commonwealth from the project.

**Standard 2: Peak Rate Attenuation - Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.**

For the purpose of analyzing pre and post development stormwater peak rates of runoff, three (3) design points have been selected based on existing topographic conditions which were used for both the pre and the post peak rate calculations. The design points are Massachusetts Avenue to the southwest, the abutting property to the east and the abutting property to the north.

The storm event rainfall frequencies used for this analysis have been selected based upon the Extreme Precipitation Tables for the Northeast Regional Climate Center. A full detail of peak rate attenuation along with supplemental stormwater calculations utilizing HydroCAD as well as pre and post drainage site plans have been submitted with the Definitive Subdivision Application. The details of this report will show that the peak rates of runoff for the 2-year, 10-year, 50-year and 100-year events have been either maintained or reduced from pre to post conditions through the use of a subsurface infiltration system.

The hydrologic calculations from the HydroCAD® have been included in this report and are located in section tab entitled "Hydrologic Calculations".

### **Proposed Design Points and Subcatchment Areas**

Design Point #1 (DP#1) is Massachusetts Avenue to the southwest. The contributing area to the Design Point consists of Subcatchment 1 & 101.

#### **Design Point #1:**

<u>Storm Event</u>	<u>Existing Conditions (Pre)</u>	<u>Proposed Conditions (Post)</u>
	<u>Peak Flow (CFS)</u>	<u>Peak Flow (CFS)</u>
2-Year (4.04 in./hr.)	0.2	0.2
10-Year (6.43 in./hr.)	0.5	0.4
50-Year (9.69 in./hr.)	1.1	0.7
100-Year (11.50 in./hr.)	1.4	0.9

Design Point #2 (DP#2) is the abutting bordering property to the east. The contributing area to the Design Point consists of Subcatchment 2, 2.1 & 201, 202.

#### **Design Point #2:**

<u>Storm Event</u>	<u>Existing Conditions (Pre)</u>	<u>Proposed Conditions (Post)</u>
	<u>Peak Flow (CFS)</u>	<u>Peak Flow (CFS)</u>
2-Year (4.04 in./hr.)	0.9	0.3
10-Year (6.43 in./hr.)	2.2	0.8
50-Year (9.69 in./hr.)	4.3	1.6
100-Year (11.50 in./hr.)	6.0	2.7

Design Point #2 (DP#2) is the abutting bordering property to the north. The contributing area to the Design Point consists of Subcatchment 3 & 301.

#### **Design Point #3:**

<u>Storm Event</u>	<u>Existing Conditions (Pre)</u>	<u>Proposed Conditions (Post)</u>
	<u>Peak Flow (CFS)</u>	<u>Peak Flow (CFS)</u>
2-Year (4.04 in./hr.)	0.2	0.2
10-Year (6.43 in./hr.)	0.4	0.4
50-Year (9.69 in./hr.)	0.6	0.6
100-Year (11.50 in./hr.)	0.8	0.8

**Standard 3: Recharge - Loss of annual recharge to groundwater shall be eliminated or minimized...at a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume in accordance with the Mass Stormwater Handbook.**

Loss of annual recharge to groundwater has been minimized through the use of stormwater Best Management Practices (BMP's), one (1) subsurface infiltration system, and a proposed operation and maintenance program are proposed for this project. One (1) subsurface infiltration system has been designed for recharging groundwater.

The classification is based upon the Natural Resource Conservation Service Maps dated May 1984 (map located in the Appendix to the narrative) the site consists of a mix of unclassified and Hydrological Group D soils. Onsite soil testing was conducted by Patriot Engineering on September 22, 2021 in the areas depicted on the attached plan. This testing revealed a gravelly loamy sand parent material, which yields a Rawls Soil Group classification of A soils. Groundwater was not in either of the two test pit locations; therefore, the bottom of those test pits has been used as the estimated seasonal high groundwater elevation for design purposes.

Utilizing the current regulations, the proposed design will meet this standard as per the following calculation:

$$Rv = Fx$$

Rv = Required Recharge Volume

F = Target Depth Factor associated with hydrologic soil groups located in table 2.3.2 in Volume 3 of the Stormwater Management Handbook

x = Total impervious area proposed

Impervious area within project area (HSG A): 27,765 square feet (sf).

Required recharge volume depth factor for A type soils: 0.6 inches

Therefore Rv =

$$(27,765)(0.6\text{ inches}/12\text{ inches per foot})$$

$$Rv = 1,388 \text{ cubic feet (cf)}$$

The proposed subsurface infiltration system provides a total recharge storage volume of 10,498 cf below the outlet.

In accordance with the Stormwater Handbook, a capture area adjustment calculation has been provided in the appendix of this report to ensure a minimum of 65% of the site impervious areas are directed into recharge facilities. The calculation demonstrates the proposed project directs 92% of the site's proposed impervious surface areas will be directed toward the recharge facility.

**Standard 4: Water Quality – Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, stormwater**

**BMP's sized to capture required water quality volume, and pretreatment measures.**

The stormwater management system has been designed to remove a minimum of 80% of the average annual post-construction load of Total Suspended Solids (TSS). These percentages have been achieved by the use of a subsurface infiltration system which is collecting the runoff from the proposed roof ("clean runoff") via roof drains and downspouts and portions of proposed bituminous concrete and stone dust walkways with associated grassed/landscaped areas via area drains with sumps and underground piping.

The Stormwater Management Handbook assigns TSS removal percentages to each treatment BMP. Each treatment BMP is sized to capture the required water quality volume as calculated in accordance with the Handbook in order to achieve the assigned TSS removal rates.

General Equation from Stormwater Management Handbook

$$V_{wq} = (D_{wq})(A)$$

$V_{wq}$  = required water quality volume

$D_{wq}$  = water quality depth (1" for critical areas, 0.5" for non-critical areas)

A = impervious area

The following are treatment sizing calculations for portions of the treatment trains based on the 0.5" for non-critical areas:

**Train 1** (Roof area/bit. conc. walk drains to PSIS)

$$V_{wq} = (25,522)(0.5"/12) = 1,063 \text{ cf}$$

The proposed subsurface infiltration system provides a total recharge storage volume of 10,498 cf below the outlet.

A separate document entitled "Operation and Maintenance & Erosion and Sedimentation Control Program for a Proposed Stormwater Management System" is included as part of this report. Suitable practices for source control and long-term pollution prevention have been identified and shall be implemented as discussed.

The utilization of pretreatment and treatment BMP's combined with the operation and maintenance plan provides compliance with this standard.

**Standard 5: Land Uses with Higher Potential Pollutant Loads (UHPPLs) – Source control and pollution prevention shall be implemented in accordance with the Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.**

Stormwater Standard 5 is not applicable to this project. The proposed development will not subject the site to higher potential pollutant loads as defined in the Massachusetts Department of Environmental protection Wetlands and Water Quality Regulations.

LUHPPLs are identified in 310 CMR 22.20B(2) and C(2)(a)-(k) and (m) and CMR 22.21(2)(a)(1)-(8) and (b)(1)-(6), areas within a site that are the location of activities that are subject to an individual National Pollutant Discharge Elimination System (NPDES) permit or the NPDES Multi-sector General Permit; auto fueling facilities, exterior fleet storage areas, exterior vehicle service and equipment cleaning areas; marinas and boatyards; parking lots with high-intensity-use; confined disposal facilities and disposal sites.

**Standard 6: Critical Areas – Stormwater discharges to critical areas require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas.**

Stormwater Standard 6 is not applicable to this project given that proposed stormwater does not discharge near a critical area. Critical areas being Outstanding Resource Waters and Special Resource Waters as designated in 314 CMR 4.0, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04. The design points are not considered a critical area therefore Standard #6 does not apply to this project.

**Standard 7: Redevelopments – A redevelopment project is required to meet Standards 1-6 only to the maximum extent practicable. Remaining standards shall be met as well as the project shall improve the existing conditions.**

Stormwater Standard 7 is not applicable to this project. Within the Stormwater Management Handbook (volume 1 chapter 1 page 20), the definition of a redevelopment project includes, “development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area”.

This project will not result in a reduction of impervious area in the proposed conditions.

**Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan shall be implemented.**

*An Operation and Maintenance & Erosion and Sediment Control Program for a Proposed Stormwater Management System* is included with this report. The program details the construction period operation and maintenance plan and sequencing for pollution prevention measures and erosion and sedimentation controls. Locations of erosion control measures for the project are depicted on the site plan set accompanying this report.

**Standard 9: A long term Operation and Maintenance Plan shall be implemented.**

*An Operation and Maintenance & Erosion and Sediment Control Program for a Proposed Stormwater Management System* is included with this report. The long term operation and maintenance section of the program provides details and the schedule for routine and non-routine maintenance tasks to be implemented at the completion of the project.

**Standard 10: Prohibition of Illicit Discharges – Illicit discharges to the stormwater management system are prohibited.**

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Discharges to the stormwater management system from the following activities or facilities are permissible: Firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents. All other illicit discharges are prohibited.

There are no known illicit discharges anticipated through the completion of this project. During construction and post construction procedures are provided to dissipate the potential for illicit discharges to the drainage system. Post construction preventions of illicit discharges are described in the Operation and Maintenance Program under the Good Housekeeping Practices section of the report.

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- \* Proposed Conditions
  - Watershed Routing Diagram
  - 2-Year 24 Hour Storm Event Analysis
  - 10-Year 24 Hour Storm Event Analysis
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### **Appendix:**

- \* Pre-Development Drainage Plan
- \* Post-Development Drainage Plan
- \* NRCS – Soils Map
- \* TSS Calculation
- \* Capture Area Adjustment
- \* 72-Hour Draw Down Calculations
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## CALCULATION METHODS

- TR 20 SCS Unit Hydrograph Procedure
- Runoff Curve Numbers
- Time of Concentration by TR55 Methodology
- Reach and Pond Rating by the Storage-Indication Method
- Manning Equation

## SOURCE OF DATA

- Technical Report No. 20
- Technical Report No. 55
- Extreme Precipitation Tables for the NOAA Atlas-14
- Field Survey and Soil Testing by RJ O'Connell and Associates.
- Massachusetts Stormwater Handbook February 2008

## **Calculation Objective**

The purpose of this drainage analysis is to design a stormwater management system that maintains and/or reduces the peak rates and volumes of stormwater runoff from pre-development conditions in the post development conditions for the 2, 10, 50 and 100-year design storm events

The proposed stormwater management system designed for this project will consist of the installation of one (1) subsurface infiltration system to allow for the mitigation of the runoff from the proposed impervious areas within the site.

There is one (1) proposed subsurface infiltration system to capture and mitigate stormwater runoff from the entire proposed roof and portions of the proposed walkways and grassed/landscaped areas. The installation of the subsurface infiltration system will allow the development to not have an increase in stormwater runoff (rate or volume) from the site during the 2, 10, 50 and 100-year design storms.

## **Classification of Soils**

Existing soil conditions within the limits of the watershed analyzed for this study have been categorized as:

- Urban Land: Unclassified Hydrologic Group
- Udorthents, wet substratum: Hydrologic Group D

The classification is based upon the Natural Resource Conservation Service Maps dated May 1984 (map located in the Appendix to the narrative) the site consists of a mix of Urban Land (unclassified) and Hydrological Group D soils. Onsite soil testing was conducted by RJ O'Connell & Associates on September 22, 2021 in the areas depicted on the attached plan. This testing revealed a gravelly loamy sand parent material, which yields a Rawls Soil Group classification of A soils. Groundwater was not in either of the two test pit locations; therefore, the bottom of those test pits has been used as the estimated seasonal high groundwater elevation for design purposes.

## **Selection of Storm Events**

The storm event rainfall frequencies used for this analysis have been selected based upon the Extreme Precipitation Tables for the NOAA Atlas 14. Rainfall frequency data has been provided as follows:

<b><u>Frequency</u></b>	<b><u>Rainfall [24 hour event (inch)]</u></b>
2 year	4.04
10 year	6.43
50 Year	9.69
100 year	11.50

## **Existing Site Overview**

The project site is comprised of two mixed-use lots located within the Neighborhood Office (B-1) District. The parcels are identified on the Town of Arlington Assessor's Map 55-2 as Lots 19 and 20. The subject properties have a total area of 47,085 s.f., and site features currently existing include two mixed-use dwellings, bituminous concrete driveways with parking lots, gravel areas, walkways, grassed/landscaped areas and wooded areas.

The slope of the existing site promotes overland runoff in three (3) main directions: southwesterly toward Massachusetts Avenue, easterly and northerly toward an existing parking lot on the abutting property. This result in four (4) subcatchments (SC) and three (3) design points (DP):

- **Subcatchment SC-1** – This subcatchment area consists of portions of existing mixed-use buildings, driveway/walkways and grassed areas. Stormwater runoff generated in this subcatchment flows southwest to Massachusetts Avenue to design point 1 (**DP1**).
- **Subcatchment SC-2** – This subcatchment area consists portions of existing mixed-use buildings, driveway/walkways, gravel areas, shed remnants and grassed/wooded areas. Stormwater runoff generated in this subcatchment flows east to an existing depression that overflows towards the existing parking lot on the abutting property to design point 2 (**DP2**).
- **Subcatchment SC-2.1** – This subcatchment area consists portions of existing mixed-use buildings, driveway/walkways, gravel areas and grassed/wooded areas. Stormwater runoff generated in this subcatchment flows east to an existing depression that overflows towards the existing parking lot on the abutting property to design point 2 (**DP2**).
- **Subcatchment SC-3** – This subcatchment area consists portions of existing mixed-use buildings, driveway/walkways, gravel areas, shed remnants and grassed/wooded areas. Stormwater runoff generated in this subcatchment flows north to the existing parking lot on the abutting property to design point 3 (**DP3**).

## **Proposed Site Overview**

The proposed project is comprised of the development of the existing properties into a 40B mixed-use development. The applicant is proposing a multi-story mixed-used building with residential and ground level commercial components. The building will be constructed with an interior parking garage, driveway, walkways, a stormwater management system, new utilities and associated grassed/landscaped areas.

A comprehensive stormwater management system that meets the Town of Arlington and MassDEP standards. The project proponent proposes to install a single subsurface infiltration system to collect and infiltrate stormwater run-off from the proposed structure as depicted on the Site Plans. The accompanying Stormwater Report contains supporting calculations, and an Operation and Maintenance Plan, and demonstrates that

peak rates and volumes of stormwater run-off will be maintained or reduced for the 2, 10, 50, and 100-year statistical storm events. The proposed project has been developed with the intent of maintaining the existing drainage patterns of the site to the maximum extent practicable.

The four (4) subcatchments in the post construction scenario are as follows:

- **Subcatchment SC101** – This subcatchment area consists of portions of the proposed driveway/walkway, portions of the abutting building roof area and grassed areas. Stormwater runoff generated in this subcatchment flows southwest to Massachusetts Avenue to design point 1 (**DP1**).
- **Subcatchment SC201** – This subcatchment area consists of a portion of the proposed walkway, portions of the abutting lot roofs and grassed areas. Stormwater runoff generated in this subcatchment flows east to the existing parking lot on the abutting property to design point 2 (**DP2**).
- **Subcatchment SC202** – This subcatchment area consists of proposed roof area, portions of the proposed bituminous concrete and stone dust walkways, and grassed/landscaped areas. Stormwater runoff generated in this subcatchment will be directed to proposed subsurface infiltration system (**PSIS-1**), via gutters and downspouts or area drains and pip. PSIS-1 has been designed with an overflow system that allows a portion of the stormwater runoff directed to the system to overflow east to the existing parking lot on the abutting property to design point 2 (**DP2**).
- **Subcatchment SC301** – This subcatchment area consists of proposed grass area with a mulched walkway for emergency fire access. Stormwater runoff generated in this subcatchment flows north to the existing parking lot on the abutting property to design point 3 (**DP3**).

### Summary of Flows at the Design Point

#### **Design Point 1 (DP1):**

##### Peak Rates (CFS)

DP1	2-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Existing	0.2	0.5	1.1	1.4
Proposed	0.2	0.4	0.7	0.9

##### Peak Volumes (AF)

DP1	2-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Existing	0.02	0.04	0.08	0.10
Proposed	0.01	0.03	0.05	0.06

**Design Point 2 (DP2):**

**Peak Rates (CFS)**

DP2	2-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Existing	0.9	2.2	4.3	6.2
Proposed	0.3	0.8	1.6	2.7

**Peak Volumes (AF)**

DP2	2-Year Storm*	10-Year Storm*	50-Year Storm	100-Year Storm
Existing	0.03	0.11	0.28	0.38
Proposed	0.03	0.07	0.20	0.32

\*NO FLOW FROM INFILTRATION SYSTEM

**Design Point 3 (DP3):**

**Peak Rates (CFS)**

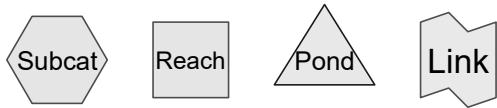
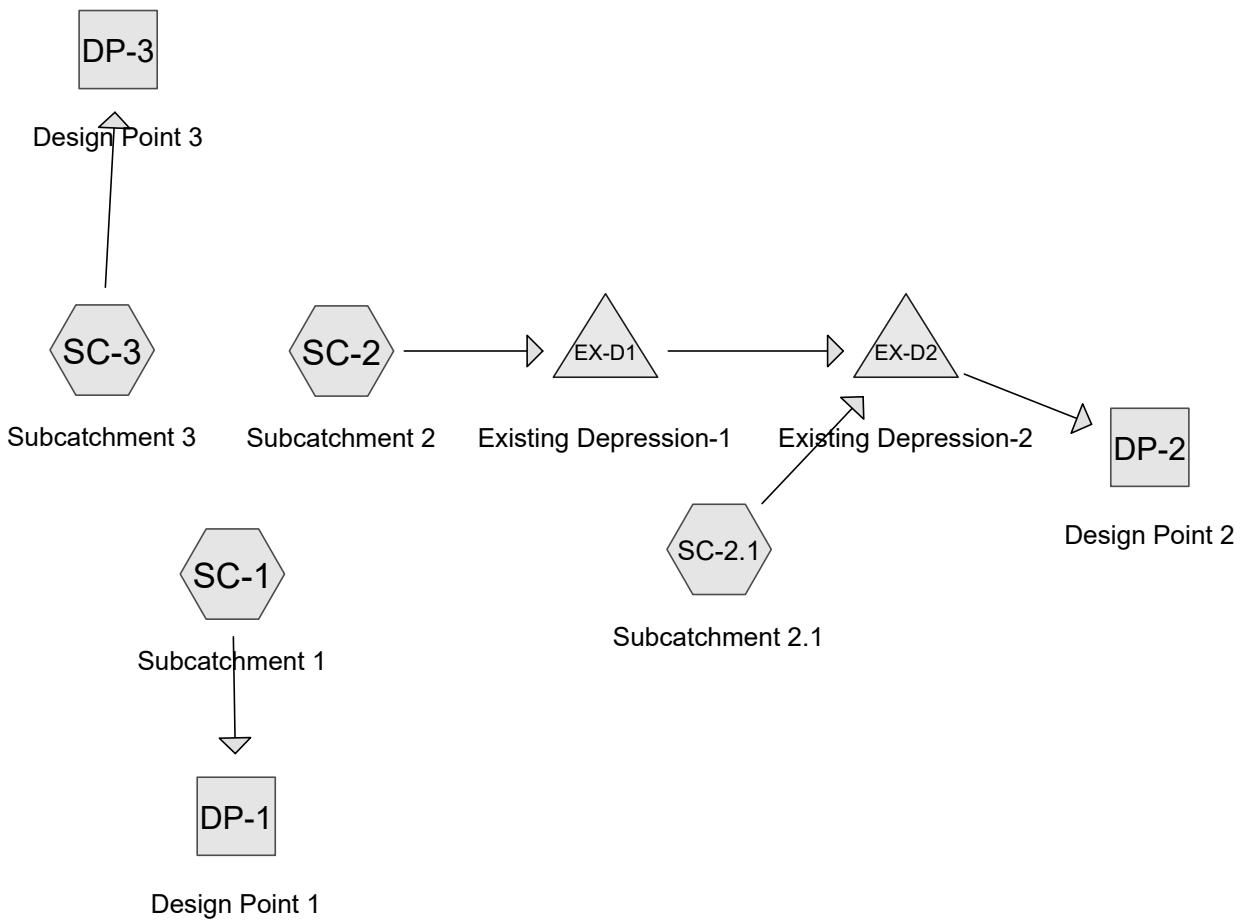
DP3	2-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Existing	0.2	0.4	0.6	0.8
Proposed	0.2	0.4	0.6	0.8

**Peak Volumes (AF)**

DP3	2-Year Storm	10-Year Storm	50-Year Storm	100-Year Storm
Existing	0.01	0.03	0.05	0.06
Proposed	0.01	0.03	0.05	0.06

**Conclusion**

The calculations for each of the selected Design Points demonstrate that proposed site improvements will not result in an increase in the peak rate or volume of stormwater runoff for the 2-year, 10-year, 50-year or 100-year 24-hour storm events at the design points with the proposed stormwater mitigation system improvements.



**Rainfall Events Listing**

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Yr 24 Hr	Type III 24-hr		Default	24.00	1	4.04	2
2	10-Yr 24 Hr	Type III 24-hr		Default	24.00	1	6.43	2
3	50-Yr 24 Hr	Type III 24-hr		Default	24.00	1	9.69	2
4	100-Yr 24 Hr	Type III 24-hr		Default	24.00	1	11.50	2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.373	39	>75% Grass cover, Good, HSG A (SC-1, SC-2, SC-2.1)
0.002	80	>75% Grass cover, Good, HSG D (SC-2.1)
0.001	98	Bulkheads (SC-2, SC-2.1)
0.039	98	Driveway/Walkways (SC-1)
0.232	98	Driveway/Walkways/Patios (SC-2, SC-2.1)
0.015	96	Gravel surface, HSG A (SC-2, SC-2.1)
0.118	98	Roof (SC-1, SC-2, SC-2.1)
0.004	98	Shed (SC-2)
0.180	30	Woods, Good, HSG A (SC-2, SC-2.1)
0.205	77	Woods, Good, HSG D (SC-2, SC-2.1, SC-3)
<b>1.169</b>	<b>65</b>	<b>TOTAL AREA</b>

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentSC-1: Subcatchment1** Runoff Area=7,364 sf 45.00% Impervious Runoff Depth>1.11"  
Flow Length=52' Slope=0.0200 '/' Tc=6.0 min CN=66 Runoff=0.2 cfs 0.02 af**SubcatchmentSC-2: Subcatchment2** Runoff Area=11,386 sf 15.47% Impervious Runoff Depth>0.21"  
Flow Length=212' Tc=11.4 min CN=46 Runoff=0.0 cfs 0.00 af**SubcatchmentSC-2.1: Subcatchment2.1** Runoff Area=28,605 sf 42.28% Impervious Runoff Depth>1.42"  
Flow Length=225' Tc=8.2 min CN=71 Runoff=0.9 cfs 0.08 af**SubcatchmentSC-3: Subcatchment3** Runoff Area=3,546 sf 0.00% Impervious Runoff Depth>1.84"  
Flow Length=57' Tc=6.0 min CN=77 Runoff=0.2 cfs 0.01 af**Reach DP-1: Design Point 1** Inflow=0.2 cfs 0.02 af  
Outflow=0.2 cfs 0.02 af**Reach DP-2: Design Point 2** Inflow=0.9 cfs 0.03 af  
Outflow=0.9 cfs 0.03 af**Reach DP-3: Design Point 3** Inflow=0.2 cfs 0.01 af  
Outflow=0.2 cfs 0.01 af**Pond EX-D1: Existing Depression-1** Peak Elev=79.19' Storage=27 cf Inflow=0.0 cfs 0.00 af  
Discarded=0.0 cfs 0.00 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.00 af**Pond EX-D2: Existing Depression-2** Peak Elev=76.59' Storage=507 cf Inflow=0.9 cfs 0.08 af  
Discarded=0.1 cfs 0.04 af Primary=0.9 cfs 0.03 af Outflow=1.0 cfs 0.08 af**Total Runoff Area = 1.169 ac Runoff Volume = 0.11 af Average Runoff Depth = 1.13"**  
**66.27% Pervious = 0.774 ac 33.73% Impervious = 0.394 ac**

**Summary for Subcatchment SC-1: Subcatchment 1**

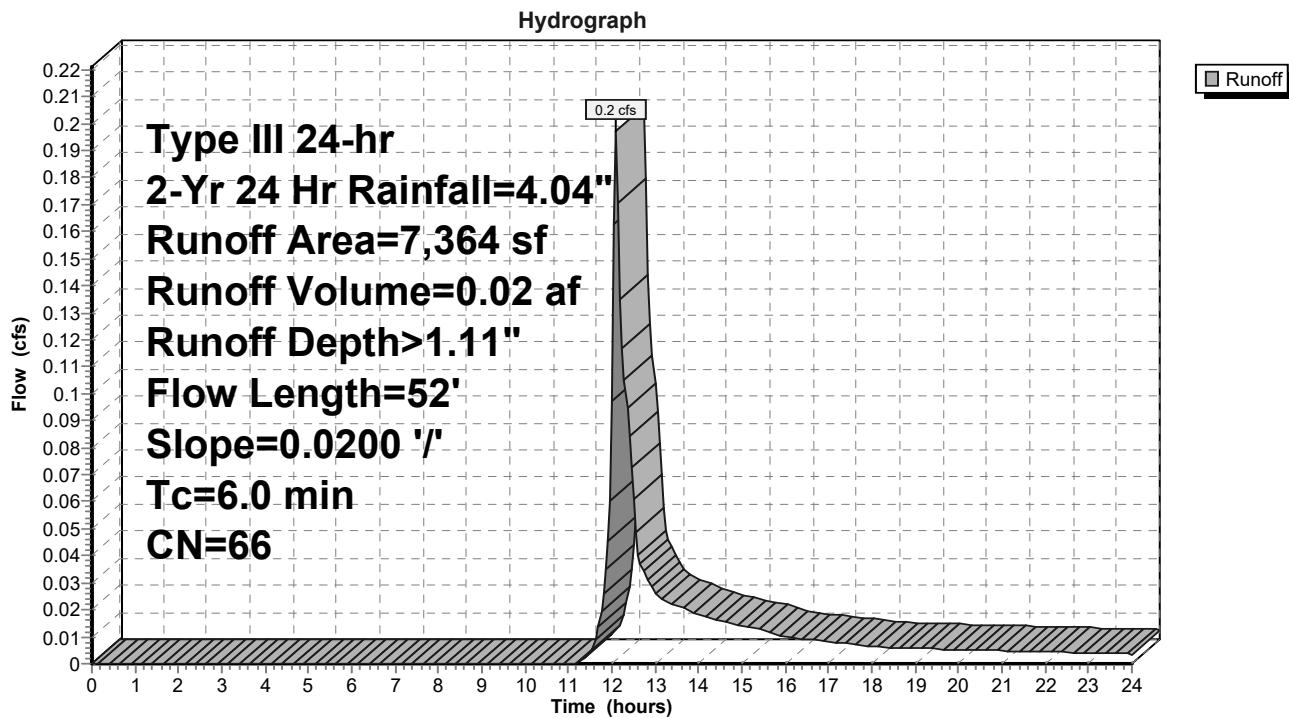
Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.02 af, Depth> 1.11"  
Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
3,644	39	>75% Grass cover, Good, HSG A
*	1,684	Driveway/Walkways
*	1,412	Roof
*	218	Roof
	406	>75% Grass cover, Good, HSG A

7,364	66	Weighted Average
4,050		55.00% Pervious Area
3,314		45.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	24	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
0.4	26	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.04"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.8					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-1: Subcatchment 1**

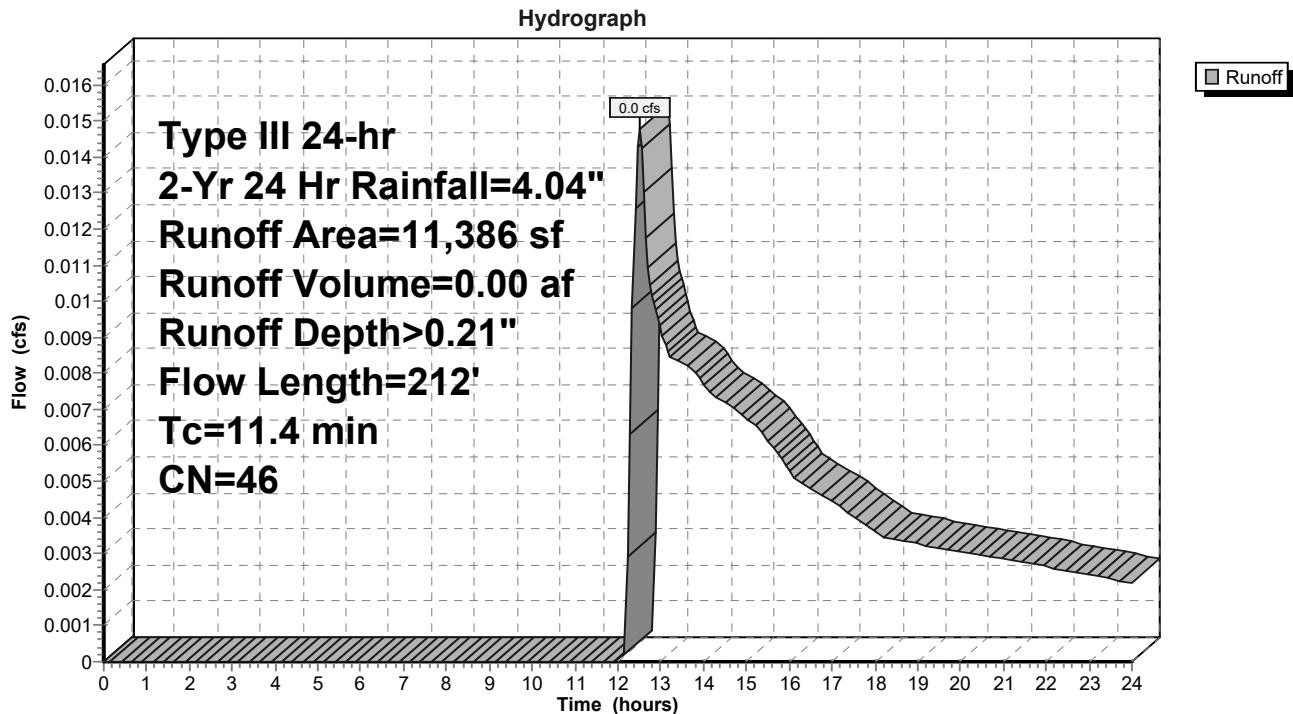
**Summary for Subcatchment SC-2: Subcatchment 2**

Runoff = 0.0 cfs @ 12.50 hrs, Volume= 0.00 af, Depth> 0.21"  
 Routed to Pond EX-D1 : Existing Depression-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
3,752	39	>75% Grass cover, Good, HSG A
23	77	Woods, Good, HSG D
*	811	Driveway/Walkways/Patios
*	735	Roof
3,208	30	Woods, Good, HSG A
*	23	Bulkheads
*	192	Shed
46	96	Gravel surface, HSG A
2,596	39	>75% Grass cover, Good, HSG A
11,386	46	Weighted Average
9,625		84.53% Pervious Area
1,761		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	21	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
7.1	29	0.0200	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.7	50	0.0600	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.8	76	0.1050	1.6		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.3	36	0.2000	2.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.4	212	Total			

**Subcatchment SC-2: Subcatchment 2**

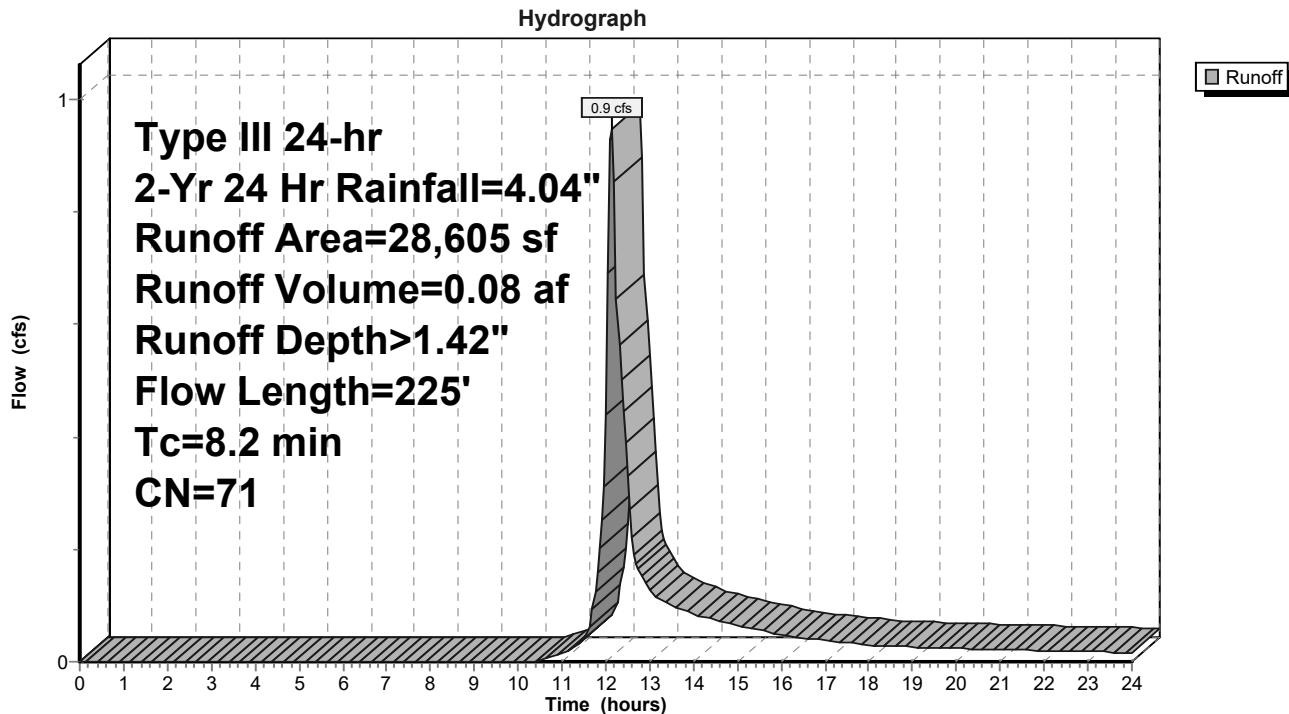
**Summary for Subcatchment SC-2.1: Subcatchment 2.1**

Runoff = 0.9 cfs @ 12.13 hrs, Volume= 0.08 af, Depth> 1.42"  
 Routed to Pond EX-D2 : Existing Depression-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
76	80	>75% Grass cover, Good, HSG D
5,371	77	Woods, Good, HSG D
*	9,310	Driveway/Walkways/Patios
*	2,765	Roof
4,626	30	Woods, Good, HSG A
*	20	Bulkheads
597	96	Gravel surface, HSG A
5,840	39	>75% Grass cover, Good, HSG A
28,605	71	Weighted Average
16,510		57.72% Pervious Area
12,095		42.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	41	0.0200	0.2		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
1.8	9	0.0560	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
1.7	119	0.0560	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.4	56	0.2210	2.4		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
8.2	225	Total			

**Subcatchment SC-2.1: Subcatchment 2.1**

### Summary for Subcatchment SC-3: Subcatchment 3

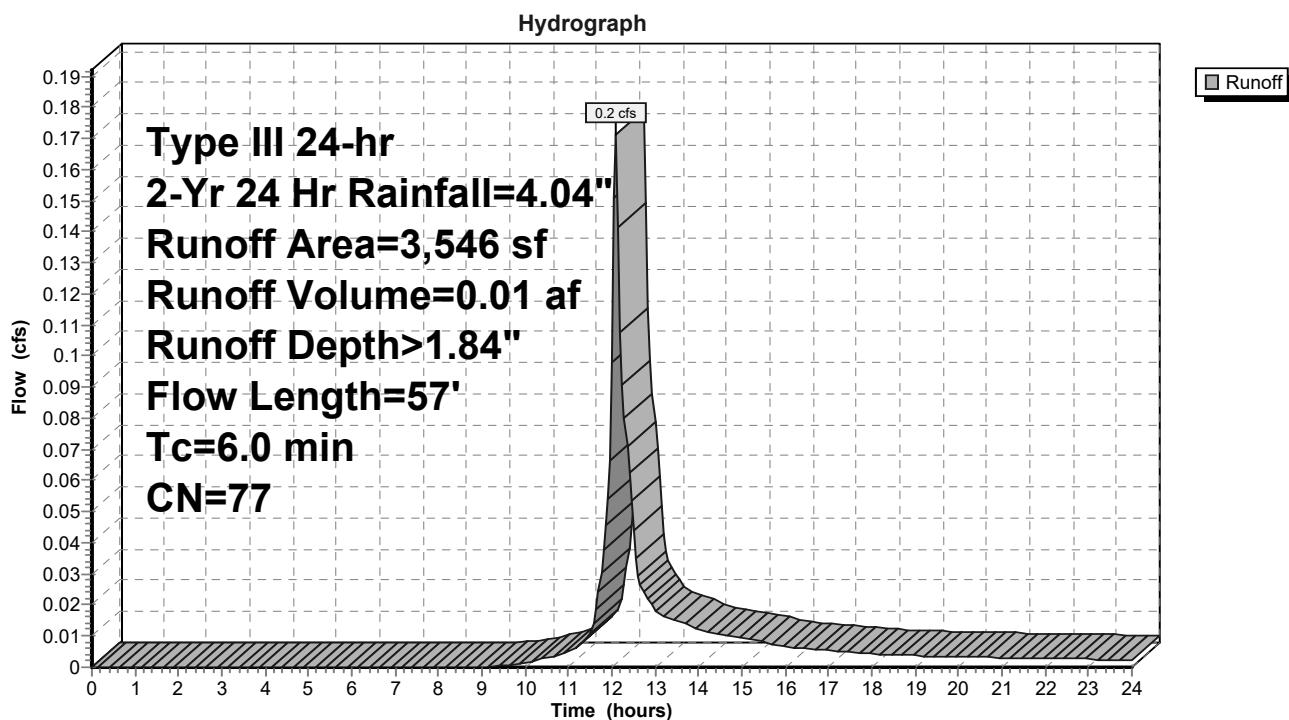
Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af, Depth> 1.84"  
Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
3,546	77	Woods, Good, HSG D
3,546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1170	0.2		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.2	7	0.0200	0.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
5.6	57				Total, Increased to minimum Tc = 6.0 min

### Subcatchment SC-3: Subcatchment 3

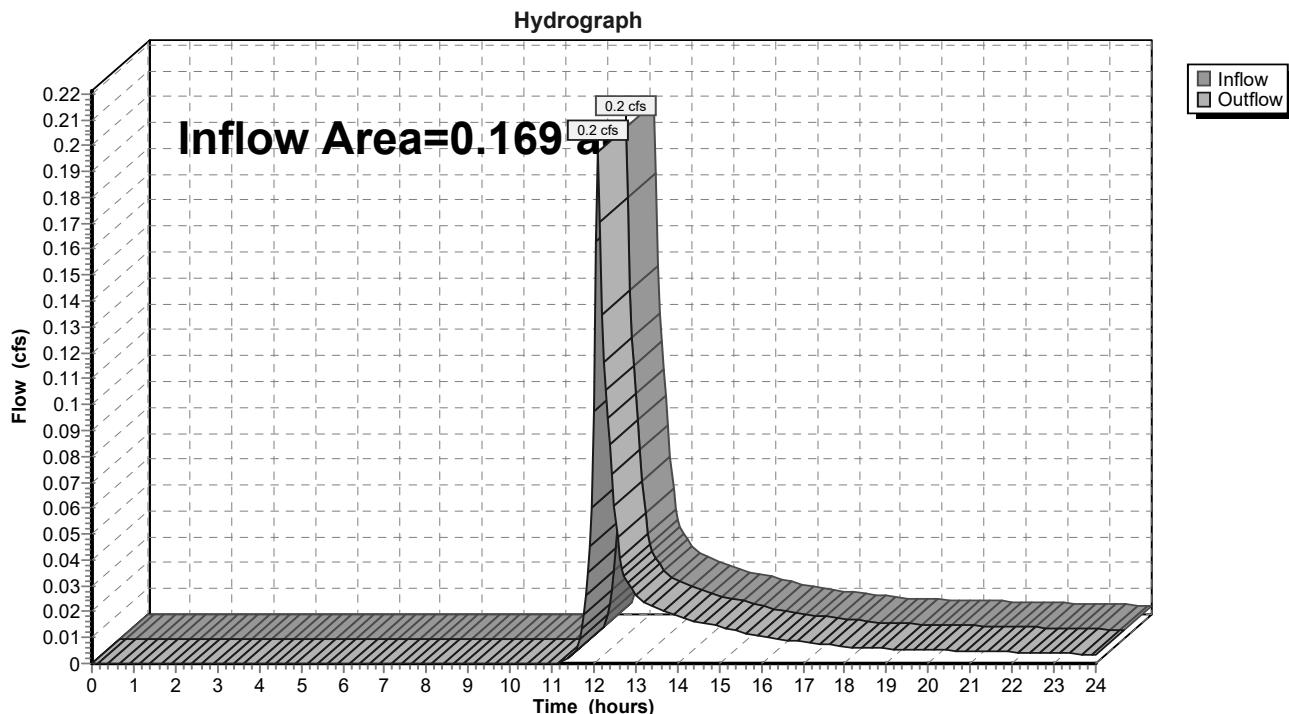


### Summary for Reach DP-1: Design Point 1

Inflow Area = 0.169 ac, 45.00% Impervious, Inflow Depth > 1.11" for 2-Yr 24 Hr event  
 Inflow = 0.2 cfs @ 12.10 hrs, Volume= 0.02 af  
 Outflow = 0.2 cfs @ 12.10 hrs, Volume= 0.02 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-1: Design Point 1



## Summary for Reach DP-2: Design Point 2

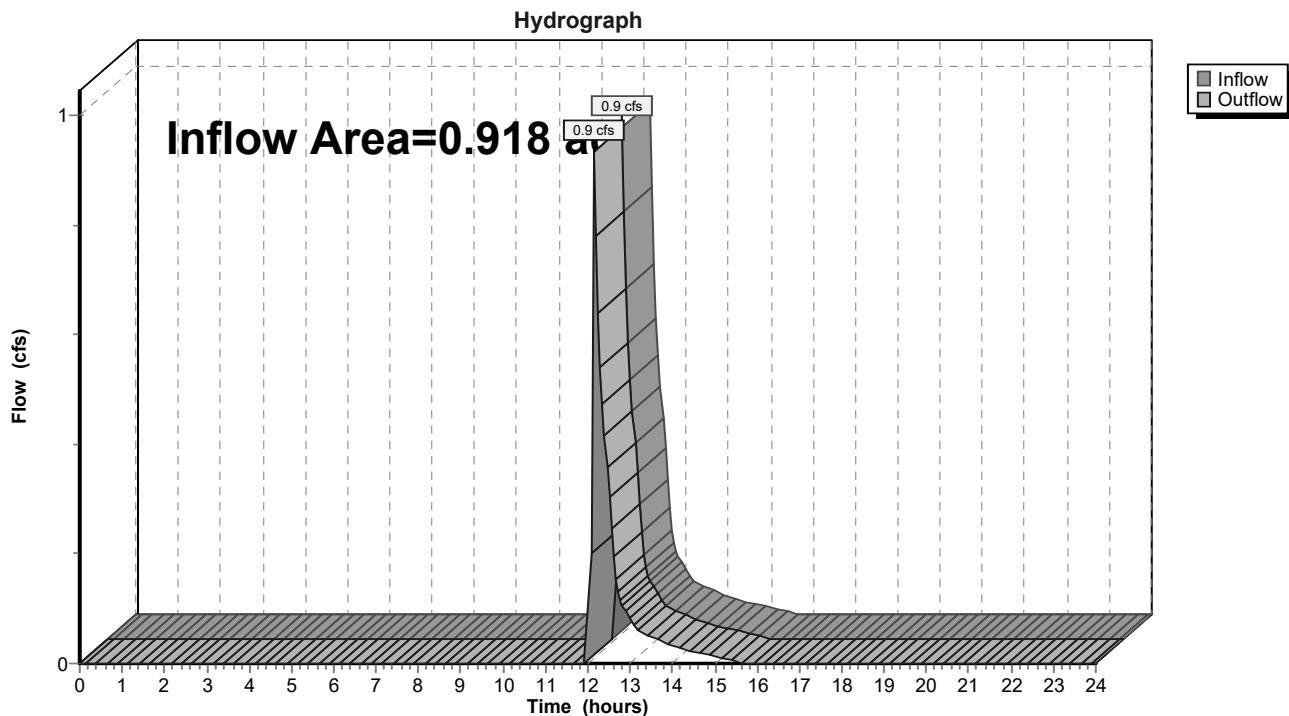
Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth = 0.41" for 2-Yr 24 Hr event

Inflow = 0.9 cfs @ 12.17 hrs, Volume= 0.03 af

Outflow = 0.9 cfs @ 12.17 hrs, Volume= 0.03 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-2: Design Point 2



### Summary for Reach DP-3: Design Point 3

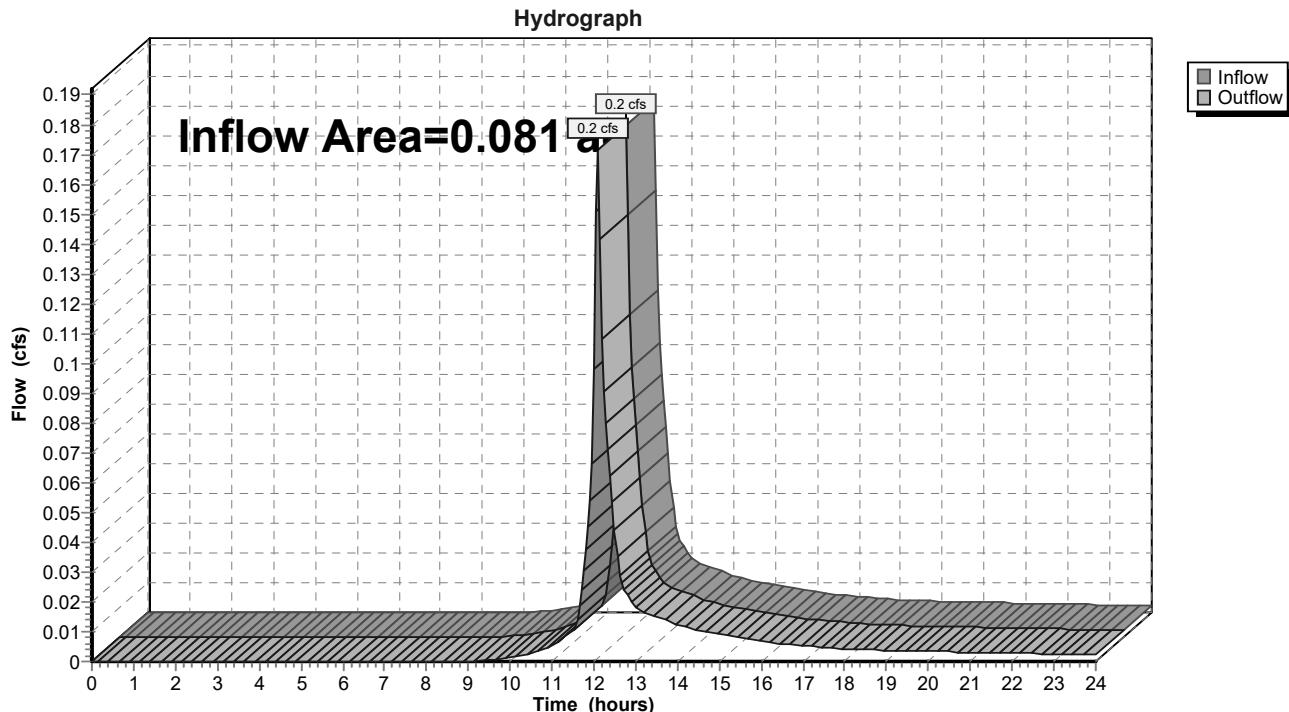
Inflow Area = 0.081 ac, 0.00% Impervious, Inflow Depth > 1.84" for 2-Yr 24 Hr event

Inflow = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af

Outflow = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-3: Design Point 3



**Summary for Pond EX-D1: Existing Depression-1**

Inflow Area = 0.261 ac, 15.47% Impervious, Inflow Depth > 0.21" for 2-Yr 24 Hr event  
 Inflow = 0.0 cfs @ 12.50 hrs, Volume= 0.00 af  
 Outflow = 0.0 cfs @ 14.71 hrs, Volume= 0.00 af, Atten= 52%, Lag= 132.6 min  
 Discarded = 0.0 cfs @ 14.71 hrs, Volume= 0.00 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af  
 Routed to Pond EX-D2 : Existing Depression-2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 79.19' @ 14.71 hrs Surf.Area= 126 sf Storage= 27 cf

Plug-Flow detention time= 51.5 min calculated for 0.00 af (98% of inflow)  
 Center-of-Mass det. time= 43.6 min ( 1,032.8 - 989.2 )

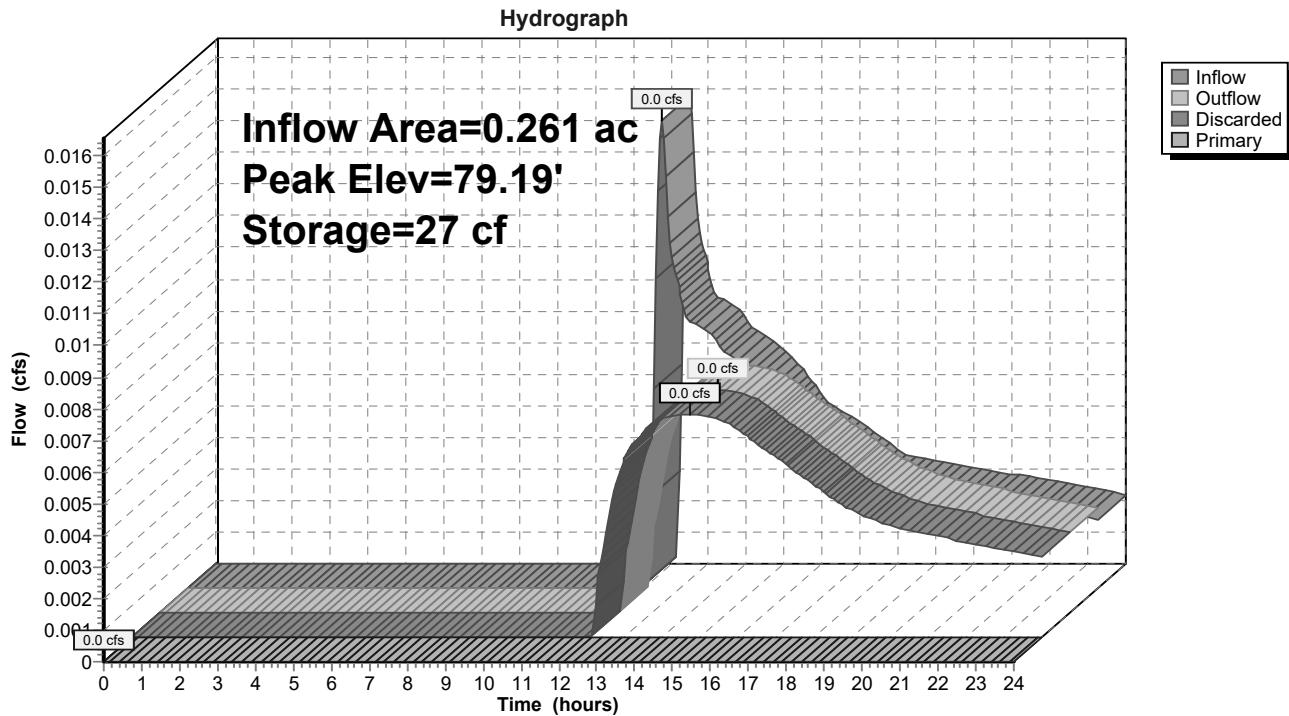
Volume	Invert	Avail.Storage	Storage Description							
#1	78.80'	819 cf	Custom Stage Data (Irregular)	Listed below (Recalc)						
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)					
78.80	32	25.0	0	0	32					
79.00	64	46.0	9	9	151					
80.00	648	104.0	305	315	847					
80.50	1,421	148.0	505	819	1,732					

Device	Routing	Invert	Outlet Devices
#1	Primary	80.10'	<b>20.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	78.80'	<b>2.410 in/hr Exfiltration over Surface area</b>

Discarded OutFlow Max=0.0 cfs @ 14.71 hrs HW=79.19' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=78.80' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir( Controls 0.0 cfs)

**Pond EX-D1: Existing Depression-1**

**Summary for Pond EX-D2: Existing Depression-2**

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth > 1.02" for 2-Yr 24 Hr event  
 Inflow = 0.9 cfs @ 12.13 hrs, Volume= 0.08 af  
 Outflow = 1.0 cfs @ 12.17 hrs, Volume= 0.08 af, Atten= 0%, Lag= 2.3 min  
 Discarded = 0.1 cfs @ 12.17 hrs, Volume= 0.04 af  
 Primary = 0.9 cfs @ 12.17 hrs, Volume= 0.03 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 76.59' @ 12.17 hrs Surf.Area= 1,103 sf Storage= 507 cf

Plug-Flow detention time= 66.2 min calculated for 0.07 af (96% of inflow)  
 Center-of-Mass det. time= 47.8 min ( 905.8 - 858.1 )

Volume	Invert	Avail.Storage	Storage Description		
#1	75.60'	519 cf	Custom Stage Data (Irregular)	Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.60	172	80.0	0	0	172
76.00	345	115.0	101	101	717
76.60	1,120	212.0	417	519	3,243

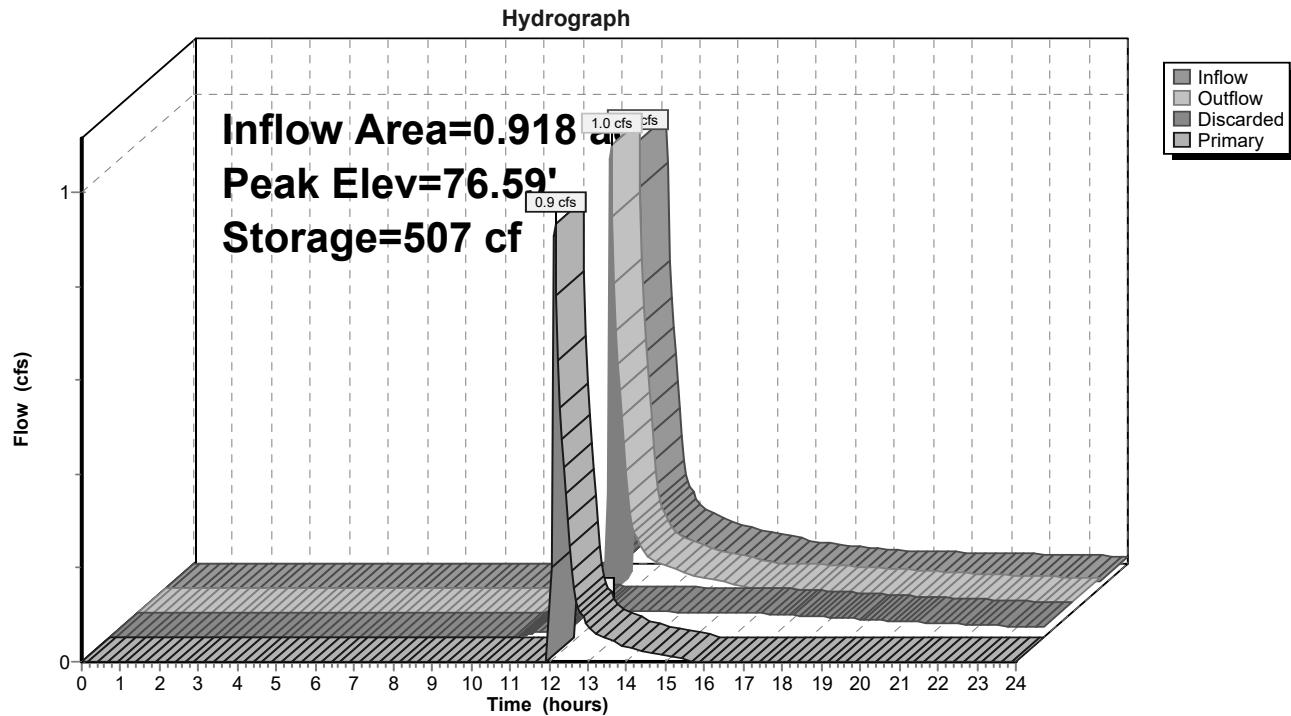
  

Device	Routing	Invert	Outlet Devices
#1	Primary	76.50'	<b>15.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	75.60'	<b>2.410 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.1 cfs @ 12.17 hrs HW=76.58' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.1 cfs)

**Primary OutFlow** Max=0.9 cfs @ 12.17 hrs HW=76.58' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir (Weir Controls 0.9 cfs @ 0.7 fps)

## Pond EX-D2: Existing Depression-2



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentSC-1: Subcatchment1** Runoff Area=7,364 sf 45.00% Impervious Runoff Depth>2.76"  
Flow Length=52' Slope=0.0200 '/' Tc=6.0 min CN=66 Runoff=0.5 cfs 0.04 af**SubcatchmentSC-2: Subcatchment2** Runoff Area=11,386 sf 15.47% Impervious Runoff Depth>1.05"  
Flow Length=212' Tc=11.4 min CN=46 Runoff=0.2 cfs 0.02 af**SubcatchmentSC-2.1: Subcatchment2.1** Runoff Area=28,605 sf 42.28% Impervious Runoff Depth>3.24"  
Flow Length=225' Tc=8.2 min CN=71 Runoff=2.3 cfs 0.18 af**SubcatchmentSC-3: Subcatchment3** Runoff Area=3,546 sf 0.00% Impervious Runoff Depth>3.85"  
Flow Length=57' Tc=6.0 min CN=77 Runoff=0.4 cfs 0.03 af**Reach DP-1: Design Point 1** Inflow=0.5 cfs 0.04 af  
Outflow=0.5 cfs 0.04 af**Reach DP-2: Design Point 2** Inflow=2.2 cfs 0.11 af  
Outflow=2.2 cfs 0.11 af**Reach DP-3: Design Point 3** Inflow=0.4 cfs 0.03 af  
Outflow=0.4 cfs 0.03 af**Pond EX-D1: Existing Depression-1** Peak Elev=79.98' Storage=301 cf Inflow=0.2 cfs 0.02 af  
Discarded=0.0 cfs 0.02 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.02 af**Pond EX-D2: Existing Depression-2** Peak Elev=76.66' Storage=519 cf Inflow=2.3 cfs 0.18 af  
Discarded=0.1 cfs 0.06 af Primary=2.2 cfs 0.11 af Outflow=2.3 cfs 0.17 af**Total Runoff Area = 1.169 ac Runoff Volume = 0.27 af Average Runoff Depth = 2.73"**  
**66.27% Pervious = 0.774 ac 33.73% Impervious = 0.394 ac**

## Summary for Subcatchment SC-1: Subcatchment 1

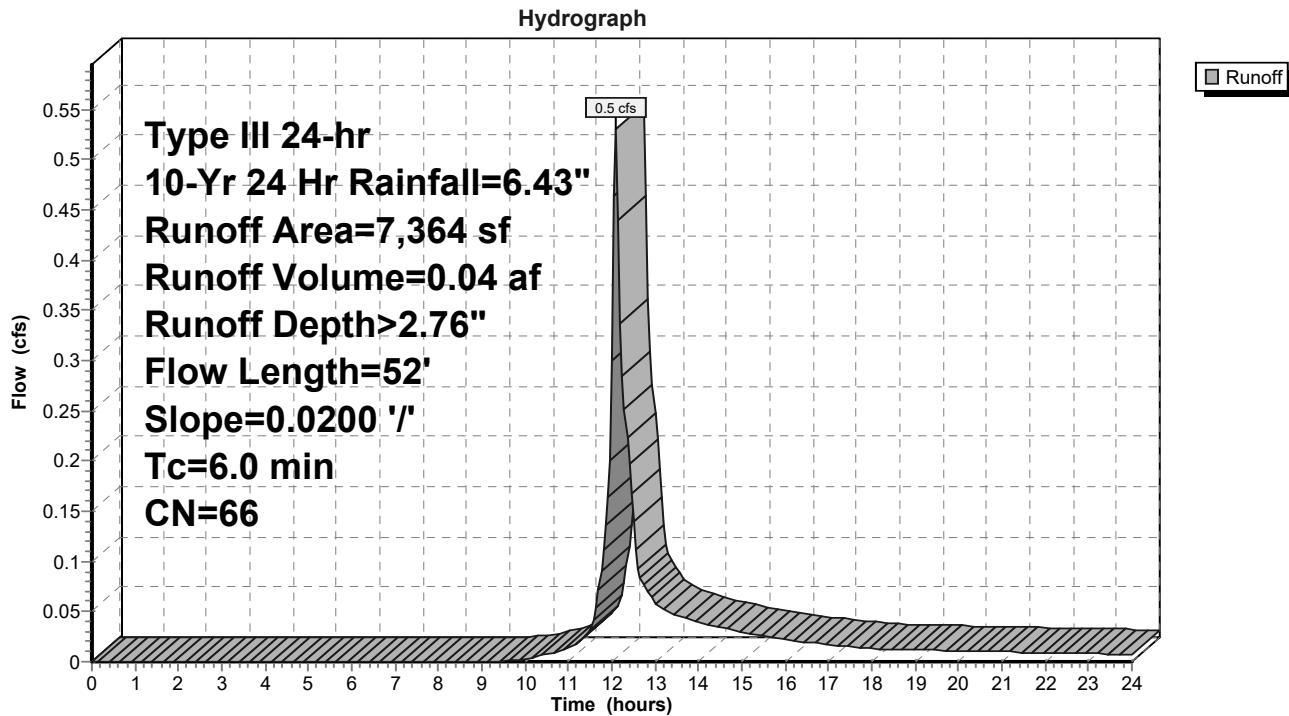
Runoff = 0.5 cfs @ 12.10 hrs, Volume= 0.04 af, Depth> 2.76"  
Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
3,644	39	>75% Grass cover, Good, HSG A
*	1,684	Driveway/Walkways
*	1,412	Roof
*	218	Roof
	406	>75% Grass cover, Good, HSG A

7,364	66	Weighted Average
4,050		55.00% Pervious Area
3,314		45.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	24	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
0.4	26	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.04"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.8					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-1: Subcatchment 1**

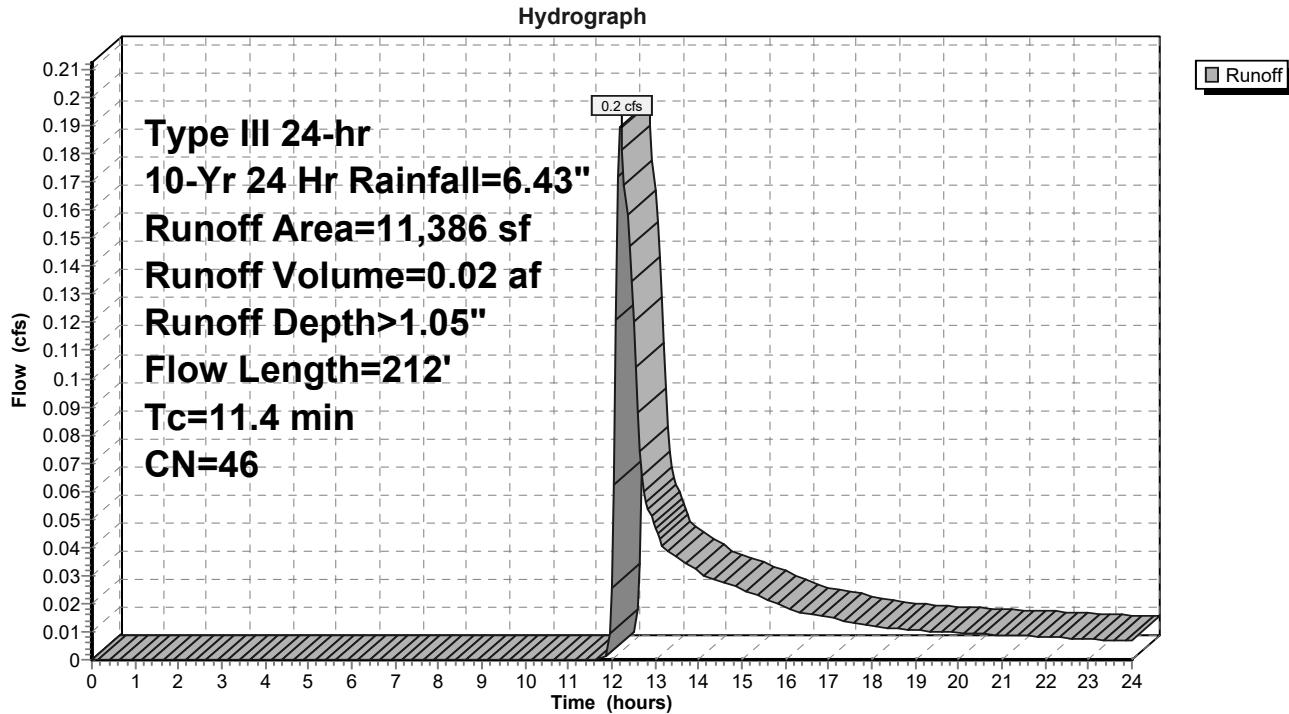
## Summary for Subcatchment SC-2: Subcatchment 2

Runoff = 0.2 cfs @ 12.21 hrs, Volume= 0.02 af, Depth> 1.05"  
Routed to Pond EX-D1 : Existing Depression-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
3,752	39	>75% Grass cover, Good, HSG A
23	77	Woods, Good, HSG D
*	811	Driveway/Walkways/Patios
*	735	Roof
3,208	30	Woods, Good, HSG A
*	23	Bulkheads
*	192	Shed
46	96	Gravel surface, HSG A
2,596	39	>75% Grass cover, Good, HSG A
11,386	46	Weighted Average
9,625		84.53% Pervious Area
1,761		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	21	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
7.1	29	0.0200	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.7	50	0.0600	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.8	76	0.1050	1.6		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.3	36	0.2000	2.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.4	212	Total			

**Subcatchment SC-2: Subcatchment 2**

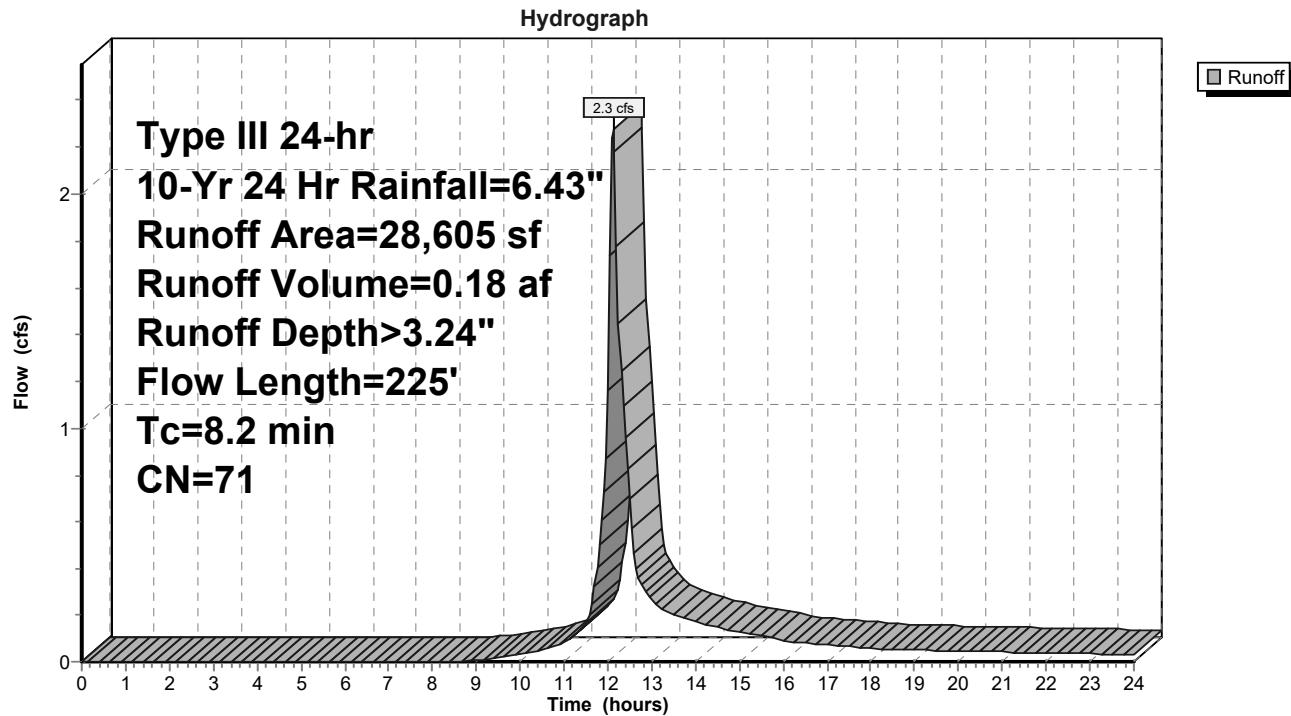
## Summary for Subcatchment SC-2.1: Subcatchment 2.1

Runoff = 2.3 cfs @ 12.12 hrs, Volume= 0.18 af, Depth> 3.24"  
Routed to Pond EX-D2 : Existing Depression-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
76	80	>75% Grass cover, Good, HSG D
5,371	77	Woods, Good, HSG D
*	9,310	Driveway/Walkways/Patios
*	2,765	Roof
4,626	30	Woods, Good, HSG A
*	20	Bulkheads
597	96	Gravel surface, HSG A
5,840	39	>75% Grass cover, Good, HSG A
28,605	71	Weighted Average
16,510		57.72% Pervious Area
12,095		42.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	41	0.0200	0.2		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
1.8	9	0.0560	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
1.7	119	0.0560	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.4	56	0.2210	2.4		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
8.2	225	Total			

**Subcatchment SC-2.1: Subcatchment 2.1**

### Summary for Subcatchment SC-3: Subcatchment 3

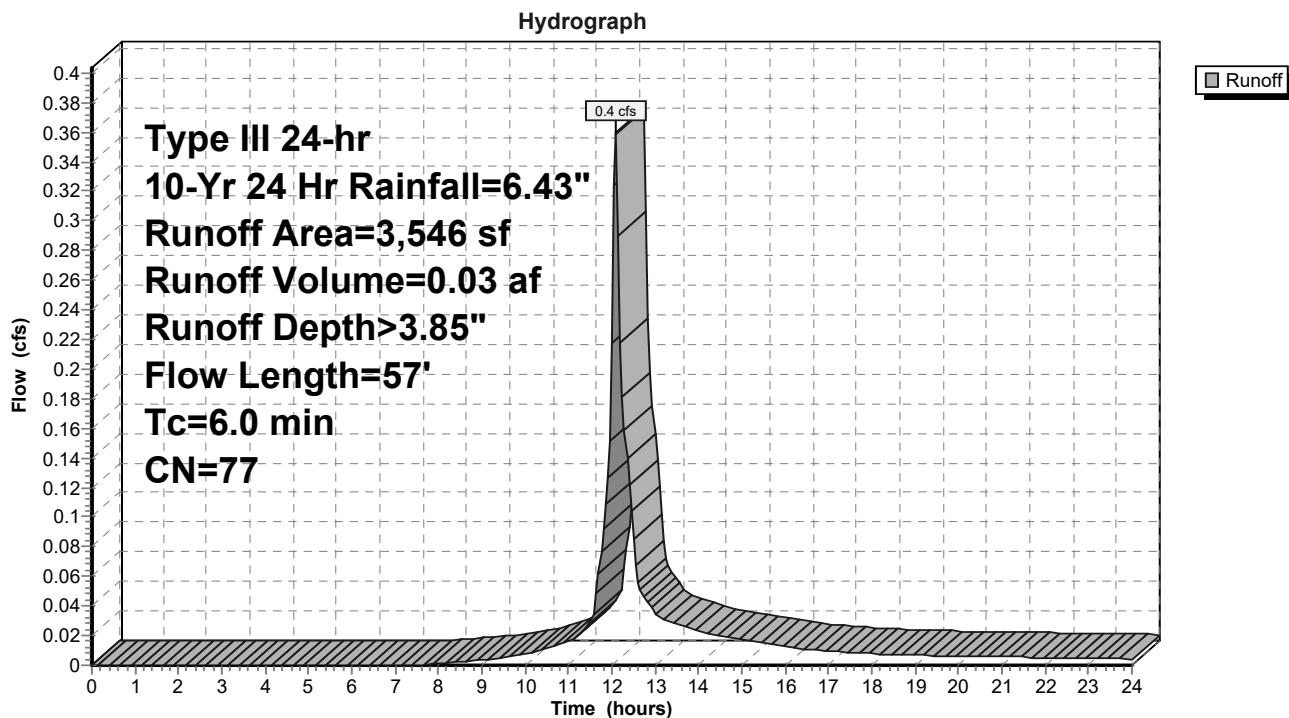
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.03 af, Depth> 3.85"  
Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
3,546	77	Woods, Good, HSG D
3,546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1170	0.2		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.2	7	0.0200	0.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
5.6	57				Total, Increased to minimum Tc = 6.0 min

### Subcatchment SC-3: Subcatchment 3



### Summary for Reach DP-1: Design Point 1

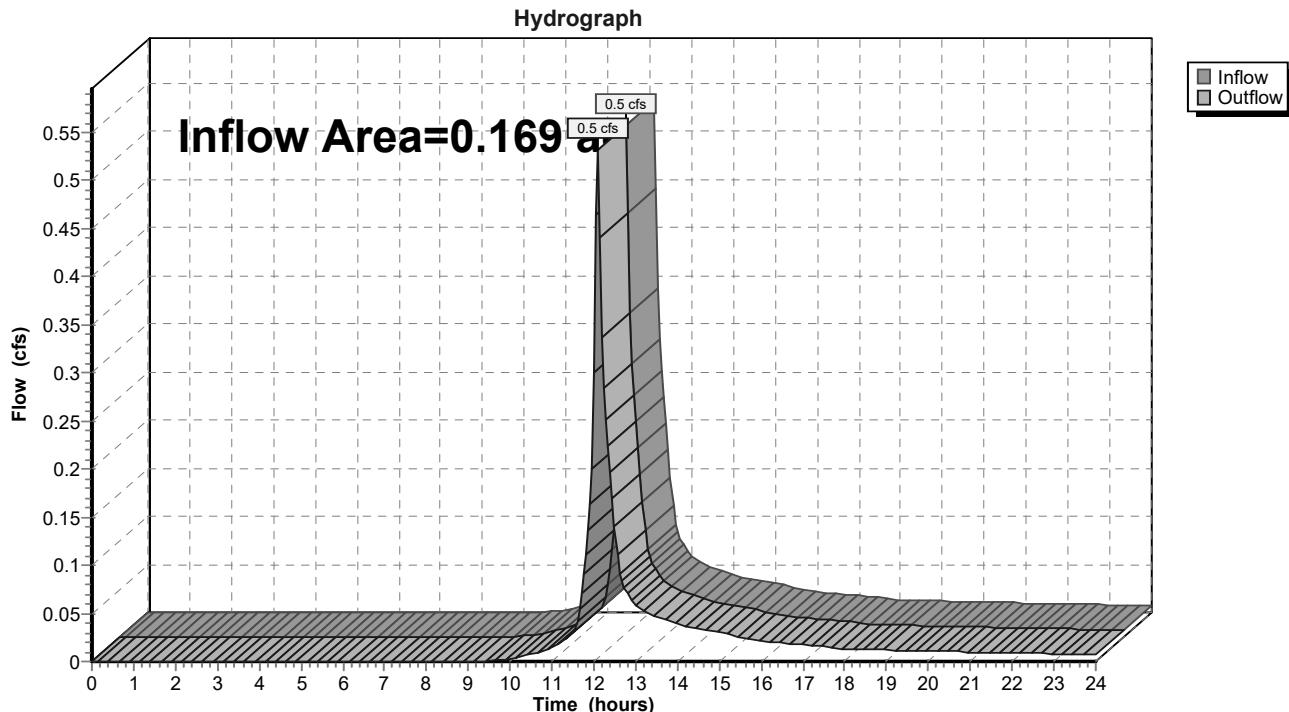
Inflow Area = 0.169 ac, 45.00% Impervious, Inflow Depth > 2.76" for 10-Yr 24 Hr event

Inflow = 0.5 cfs @ 12.10 hrs, Volume= 0.04 af

Outflow = 0.5 cfs @ 12.10 hrs, Volume= 0.04 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-1: Design Point 1

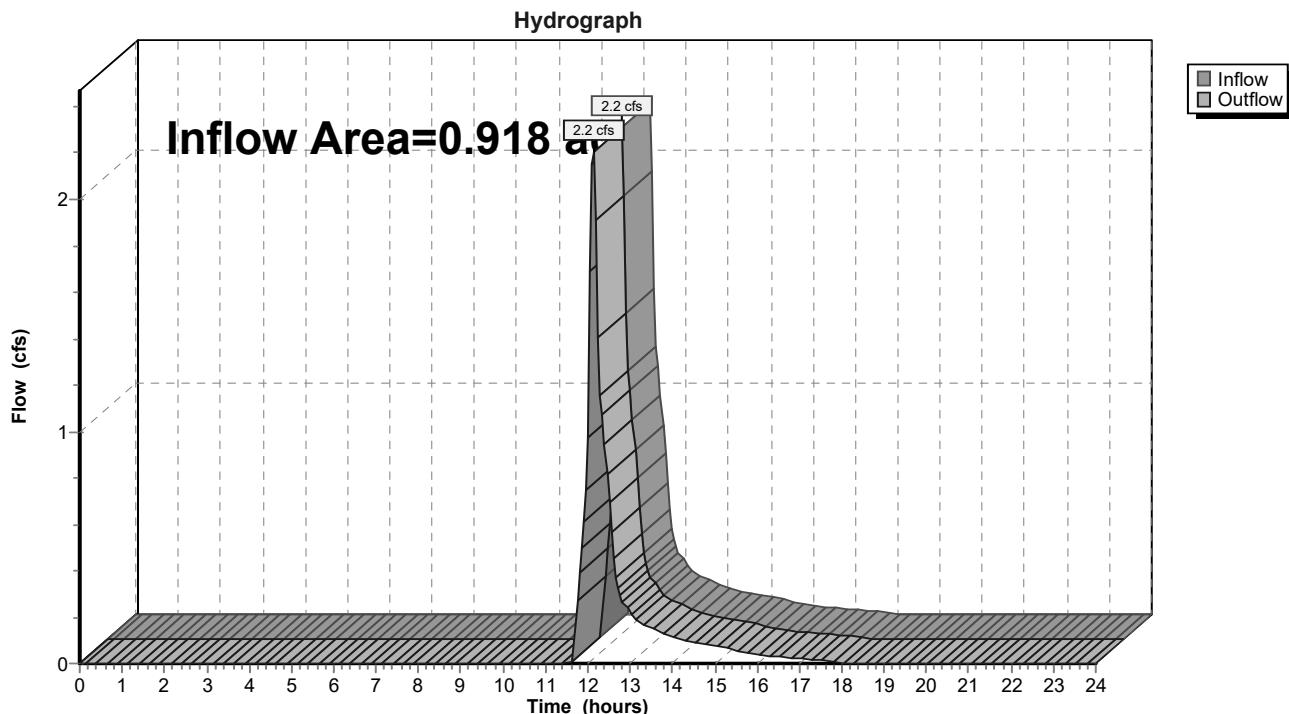


## Summary for Reach DP-2: Design Point 2

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth = 1.48" for 10-Yr 24 Hr event  
Inflow = 2.2 cfs @ 12.12 hrs, Volume= 0.11 af  
Outflow = 2.2 cfs @ 12.12 hrs, Volume= 0.11 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-2: Design Point 2

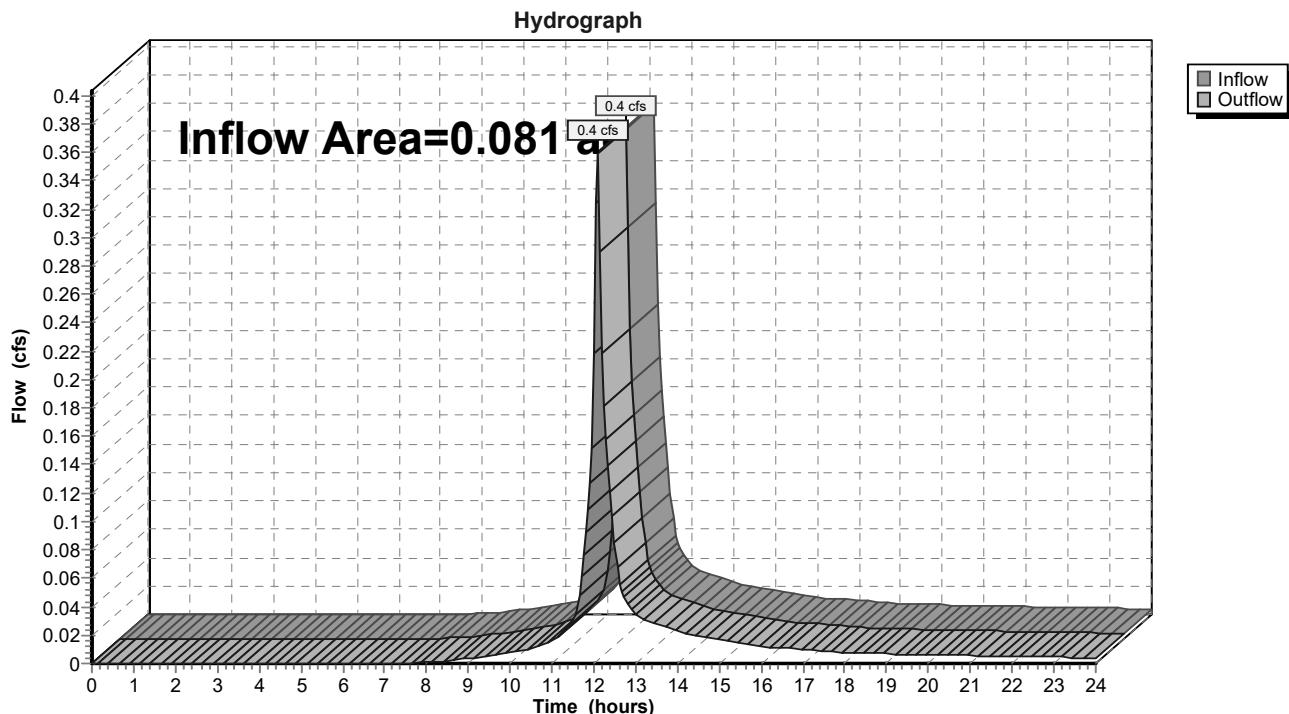


### Summary for Reach DP-3: Design Point 3

Inflow Area = 0.081 ac, 0.00% Impervious, Inflow Depth > 3.85" for 10-Yr 24 Hr event  
 Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.03 af  
 Outflow = 0.4 cfs @ 12.09 hrs, Volume= 0.03 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-3: Design Point 3



## Summary for Pond EX-D1: Existing Depression-1

Inflow Area = 0.261 ac, 15.47% Impervious, Inflow Depth > 1.05" for 10-Yr 24 Hr event  
 Inflow = 0.2 cfs @ 12.21 hrs, Volume= 0.02 af  
 Outflow = 0.0 cfs @ 13.66 hrs, Volume= 0.02 af, Atten= 81%, Lag= 87.0 min  
 Discarded = 0.0 cfs @ 13.66 hrs, Volume= 0.02 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af

Routed to Pond EX-D2 : Existing Depression-2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 79.98' @ 13.66 hrs Surf.Area= 629 sf Storage= 301 cf

Plug-Flow detention time= 118.9 min calculated for 0.02 af (96% of inflow)  
 Center-of-Mass det. time= 99.6 min ( 1,006.6 - 907.0 )

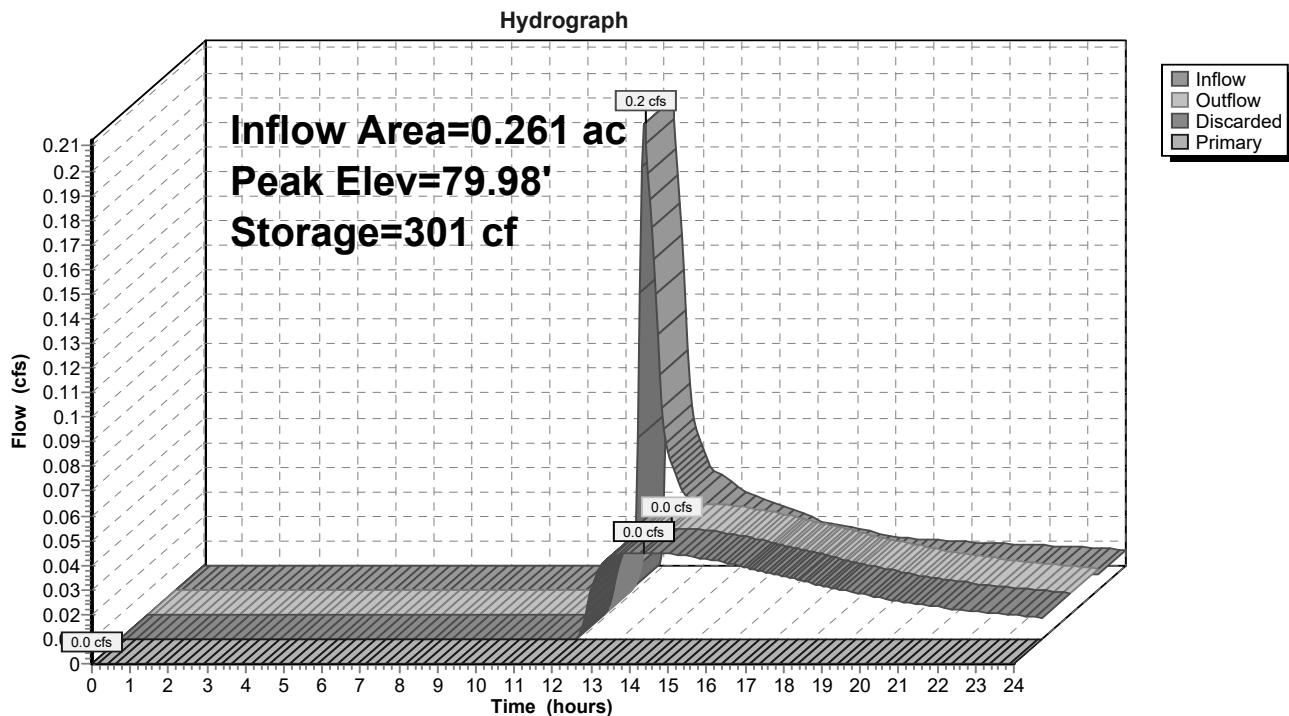
Volume	Invert	Avail.Storage	Storage Description							
#1	78.80'	819 cf	Custom Stage Data (Irregular)	Listed below (Recalc)						
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)					
78.80	32	25.0	0	0	32					
79.00	64	46.0	9	9	151					
80.00	648	104.0	305	315	847					
80.50	1,421	148.0	505	819	1,732					

Device	Routing	Invert	Outlet Devices
#1	Primary	80.10'	<b>20.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	78.80'	<b>2.410 in/hr Exfiltration over Surface area</b>

Discarded OutFlow Max=0.0 cfs @ 13.66 hrs HW=79.98' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=78.80' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir( Controls 0.0 cfs)

**Pond EX-D1: Existing Depression-1**

## Summary for Pond EX-D2: Existing Depression-2

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth > 2.32" for 10-Yr 24 Hr event  
 Inflow = 2.3 cfs @ 12.12 hrs, Volume= 0.18 af  
 Outflow = 2.3 cfs @ 12.12 hrs, Volume= 0.17 af, Atten= 1%, Lag= 0.2 min  
 Discarded = 0.1 cfs @ 12.05 hrs, Volume= 0.06 af  
 Primary = 2.2 cfs @ 12.12 hrs, Volume= 0.11 af  
 Routed to Reach DP-2 : Design Point 2

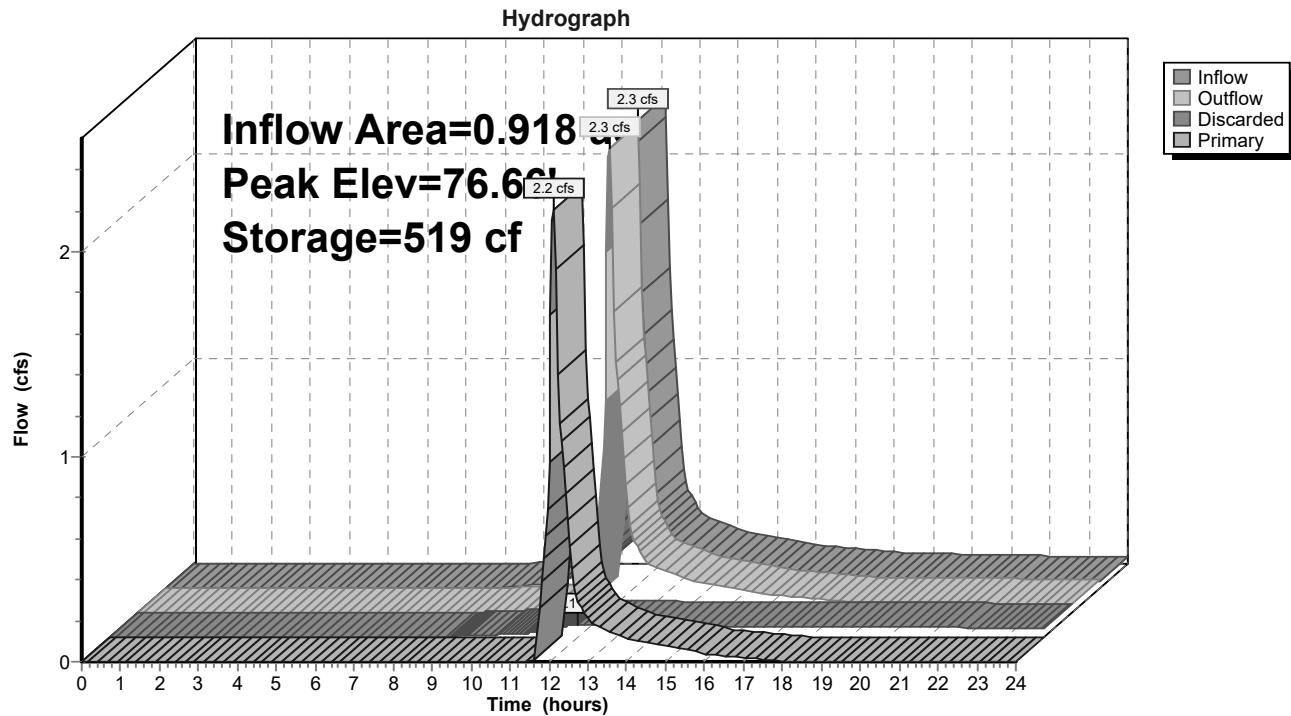
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 76.66' @ 12.12 hrs Surf.Area= 1,120 sf Storage= 519 cf

Plug-Flow detention time= 39.5 min calculated for 0.17 af (96% of inflow)  
 Center-of-Mass det. time= 19.9 min ( 853.6 - 833.7 )

Volume	Invert	Avail.Storage	Storage Description		
#1	75.60'	519 cf	<b>Custom Stage Data (Irregular)</b>	Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.60	172	80.0	0	0	172
76.00	345	115.0	101	101	717
76.60	1,120	212.0	417	519	3,243
Device	Routing	Invert	Outlet Devices		
#1	Primary	76.50'	<b>15.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b>		
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00		
			2.50 3.00 3.50 4.00 4.50 5.00 5.50		
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65		
			2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88		
#2	Discarded	75.60'	<b>2.410 in/hr Exfiltration over Surface area</b>		

**Discarded OutFlow** Max=0.1 cfs @ 12.05 hrs HW=76.63' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.1 cfs)

**Primary OutFlow** Max=2.1 cfs @ 12.12 hrs HW=76.66' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir (Weir Controls 2.1 cfs @ 0.9 fps)

**Pond EX-D2: Existing Depression-2**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentSC-1: Subcatchment1** Runoff Area=7,364 sf 45.00% Impervious Runoff Depth>5.42"  
Flow Length=52' Slope=0.0200 '/' Tc=6.0 min CN=66 Runoff=1.1 cfs 0.08 af

**SubcatchmentSC-2: Subcatchment2** Runoff Area=11,386 sf 15.47% Impervious Runoff Depth>2.82"  
Flow Length=212' Tc=11.4 min CN=46 Runoff=0.7 cfs 0.06 af

**SubcatchmentSC-2.1: Subcatchment2.1** Runoff Area=28,605 sf 42.28% Impervious Runoff Depth>6.07"  
Flow Length=225' Tc=8.2 min CN=71 Runoff=4.3 cfs 0.33 af

**SubcatchmentSC-3: Subcatchment3** Runoff Area=3,546 sf 0.00% Impervious Runoff Depth>6.84"  
Flow Length=57' Tc=6.0 min CN=77 Runoff=0.6 cfs 0.05 af

**Reach DP-1: Design Point 1** Inflow=1.1 cfs 0.08 af  
Outflow=1.1 cfs 0.08 af

**Reach DP-2: Design Point 2** Inflow=4.3 cfs 0.28 af  
Outflow=4.3 cfs 0.28 af

**Reach DP-3: Design Point 3** Inflow=0.6 cfs 0.05 af  
Outflow=0.6 cfs 0.05 af

**Pond EX-D1: Existing Depression-1** Peak Elev=80.15' Storage=430 cf Inflow=0.7 cfs 0.06 af  
Discarded=0.0 cfs 0.04 af Primary=0.6 cfs 0.02 af Outflow=0.6 cfs 0.06 af

**Pond EX-D2: Existing Depression-2** Peak Elev=76.74' Storage=519 cf Inflow=4.3 cfs 0.35 af  
Discarded=0.1 cfs 0.07 af Primary=4.3 cfs 0.28 af Outflow=4.3 cfs 0.35 af

**Total Runoff Area = 1.169 ac Runoff Volume = 0.52 af Average Runoff Depth = 5.30"**  
**66.27% Pervious = 0.774 ac 33.73% Impervious = 0.394 ac**

**Summary for Subcatchment SC-1: Subcatchment 1**

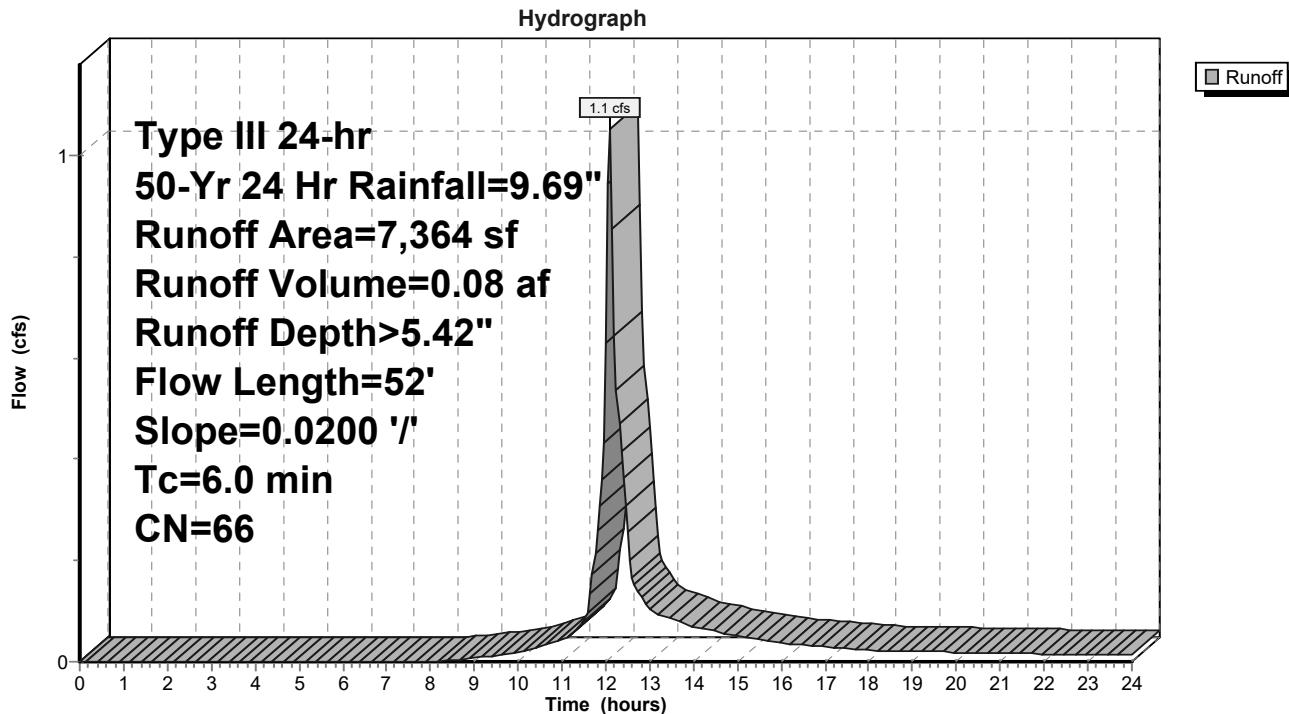
Runoff = 1.1 cfs @ 12.09 hrs, Volume= 0.08 af, Depth> 5.42"  
 Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
3,644	39	>75% Grass cover, Good, HSG A
*	1,684	Driveway/Walkways
*	1,412	Roof
*	218	Roof
	406	>75% Grass cover, Good, HSG A

7,364	66	Weighted Average
4,050		55.00% Pervious Area
3,314		45.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	24	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
0.4	26	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.04"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.8					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-1: Subcatchment 1**

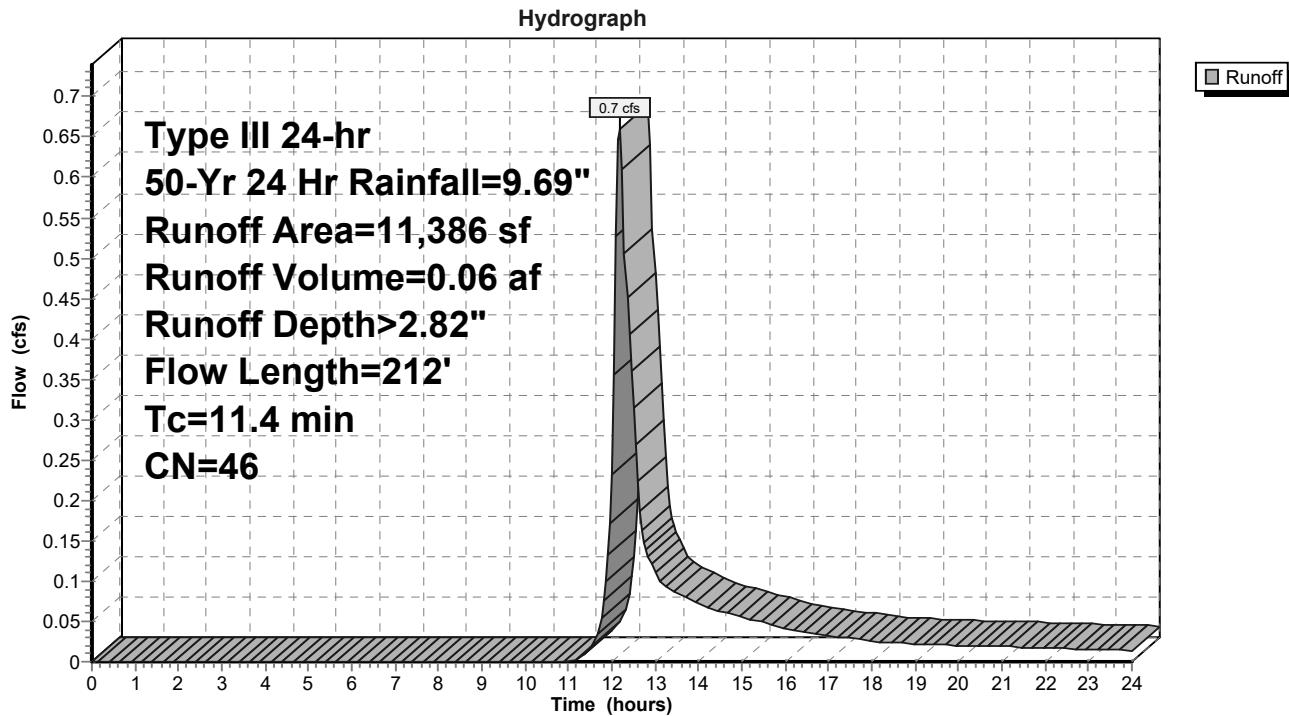
## Summary for Subcatchment SC-2: Subcatchment 2

Runoff = 0.7 cfs @ 12.17 hrs, Volume= 0.06 af, Depth> 2.82"  
Routed to Pond EX-D1 : Existing Depression-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
3,752	39	>75% Grass cover, Good, HSG A
23	77	Woods, Good, HSG D
*	811	Driveway/Walkways/Patios
*	735	Roof
3,208	30	Woods, Good, HSG A
*	23	Bulkheads
*	192	Shed
46	96	Gravel surface, HSG A
2,596	39	>75% Grass cover, Good, HSG A
11,386	46	Weighted Average
9,625		84.53% Pervious Area
1,761		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	21	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
7.1	29	0.0200	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.7	50	0.0600	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.8	76	0.1050	1.6		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.3	36	0.2000	2.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.4	212	Total			

**Subcatchment SC-2: Subcatchment 2**

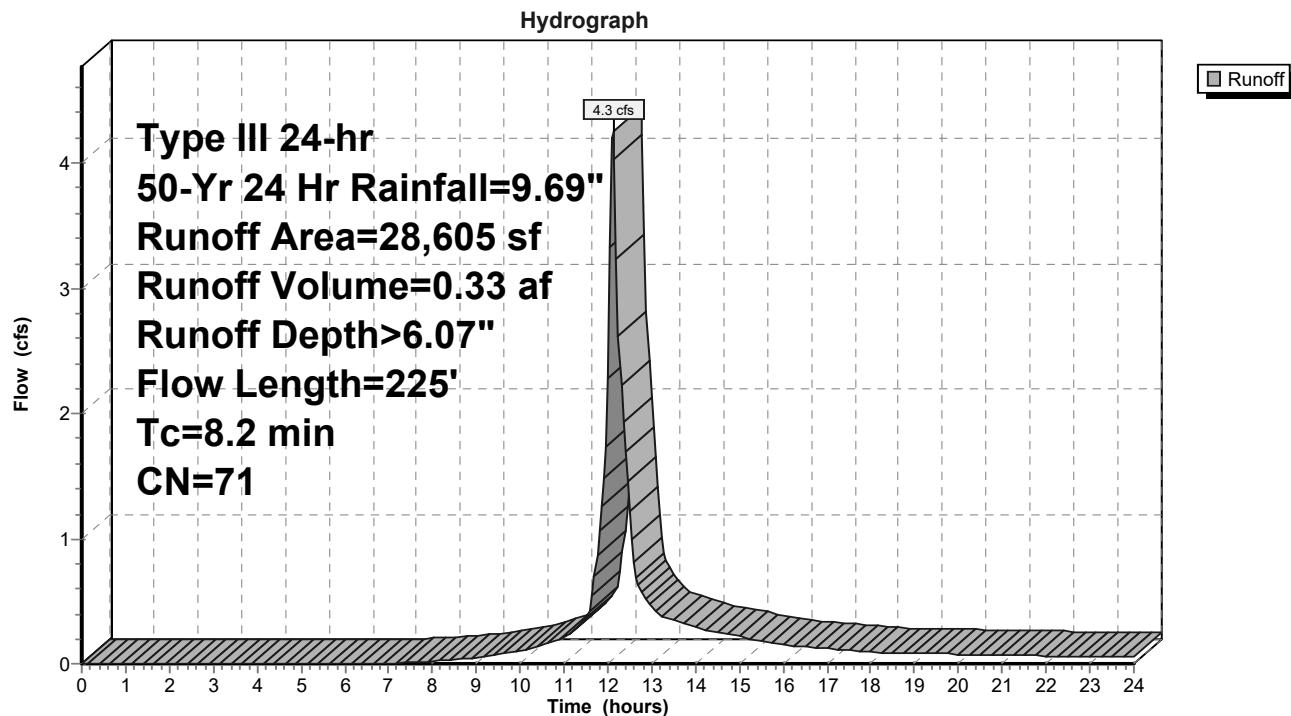
## Summary for Subcatchment SC-2.1: Subcatchment 2.1

Runoff = 4.3 cfs @ 12.12 hrs, Volume= 0.33 af, Depth> 6.07"  
 Routed to Pond EX-D2 : Existing Depression-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
76	80	>75% Grass cover, Good, HSG D
5,371	77	Woods, Good, HSG D
*	9,310	Driveway/Walkways/Patios
*	2,765	Roof
4,626	30	Woods, Good, HSG A
*	20	Bulkheads
597	96	Gravel surface, HSG A
5,840	39	>75% Grass cover, Good, HSG A
28,605	71	Weighted Average
16,510		57.72% Pervious Area
12,095		42.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	41	0.0200	0.2		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
1.8	9	0.0560	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
1.7	119	0.0560	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.4	56	0.2210	2.4		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
8.2	225	Total			

**Subcatchment SC-2.1: Subcatchment 2.1**

### Summary for Subcatchment SC-3: Subcatchment 3

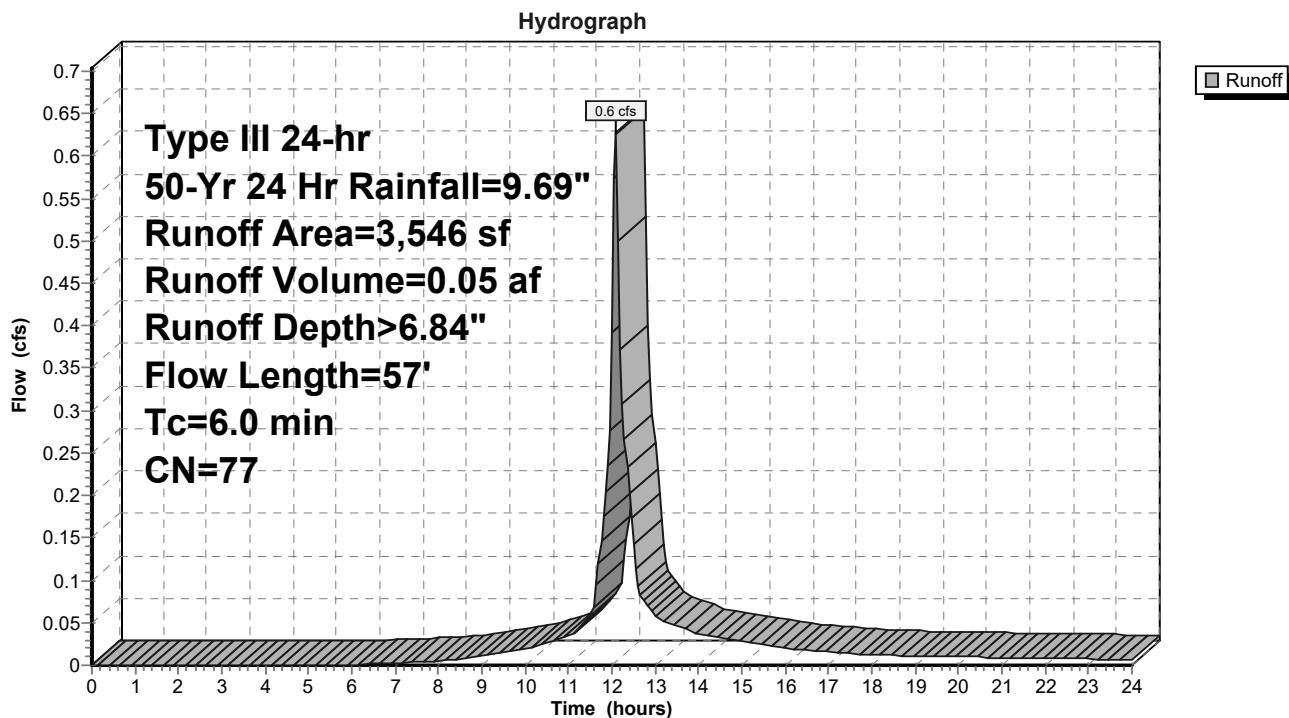
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.05 af, Depth> 6.84"  
Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
3,546	77	Woods, Good, HSG D
3,546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1170	0.2		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.2	7	0.0200	0.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
5.6	57				Total, Increased to minimum Tc = 6.0 min

### Subcatchment SC-3: Subcatchment 3



### Summary for Reach DP-1: Design Point 1

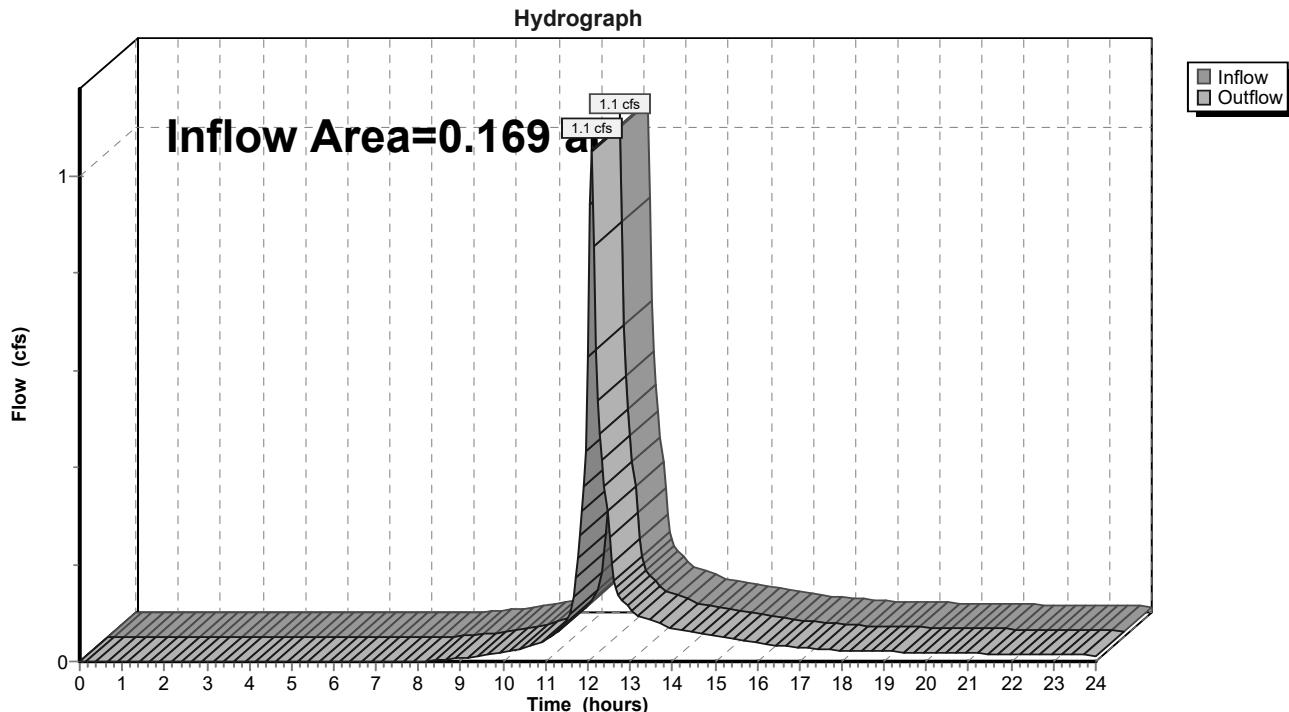
Inflow Area = 0.169 ac, 45.00% Impervious, Inflow Depth > 5.42" for 50-Yr 24 Hr event

Inflow = 1.1 cfs @ 12.09 hrs, Volume= 0.08 af

Outflow = 1.1 cfs @ 12.09 hrs, Volume= 0.08 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-1: Design Point 1



## Summary for Reach DP-2: Design Point 2

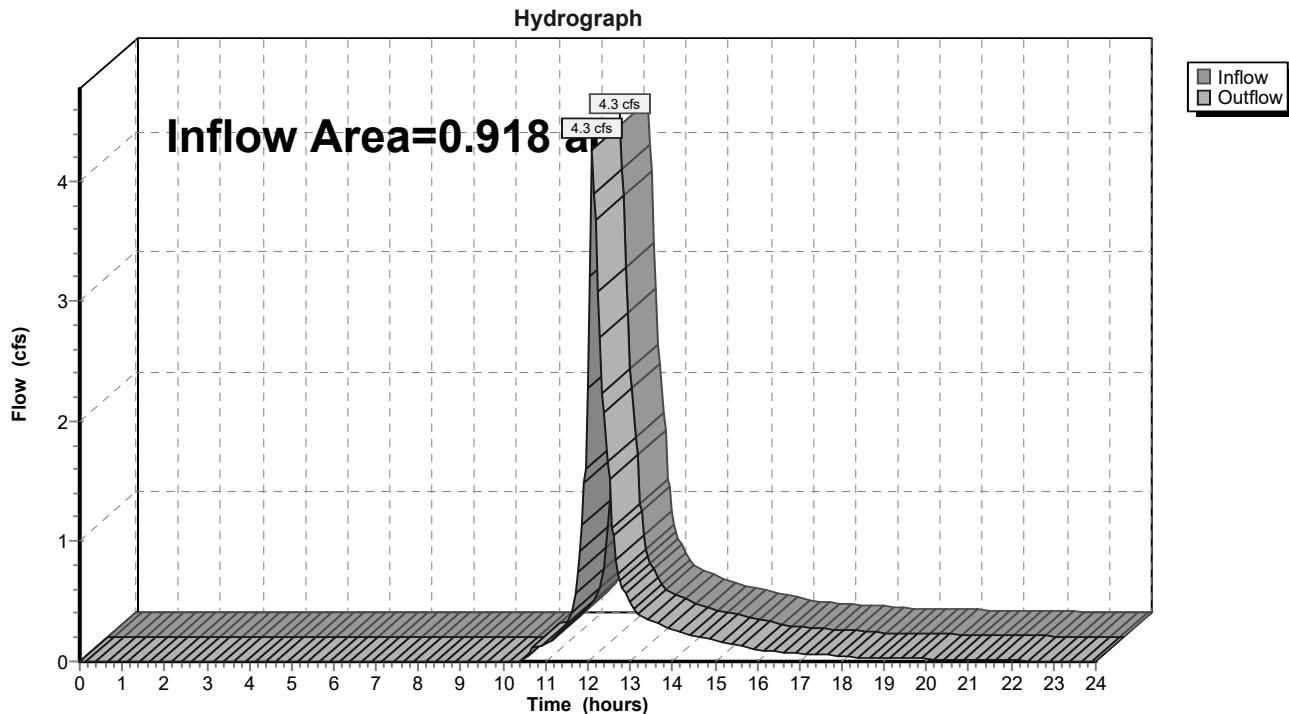
Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth = 3.63" for 50-Yr 24 Hr event

Inflow = 4.3 cfs @ 12.11 hrs, Volume= 0.28 af

Outflow = 4.3 cfs @ 12.11 hrs, Volume= 0.28 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-2: Design Point 2



### Summary for Reach DP-3: Design Point 3

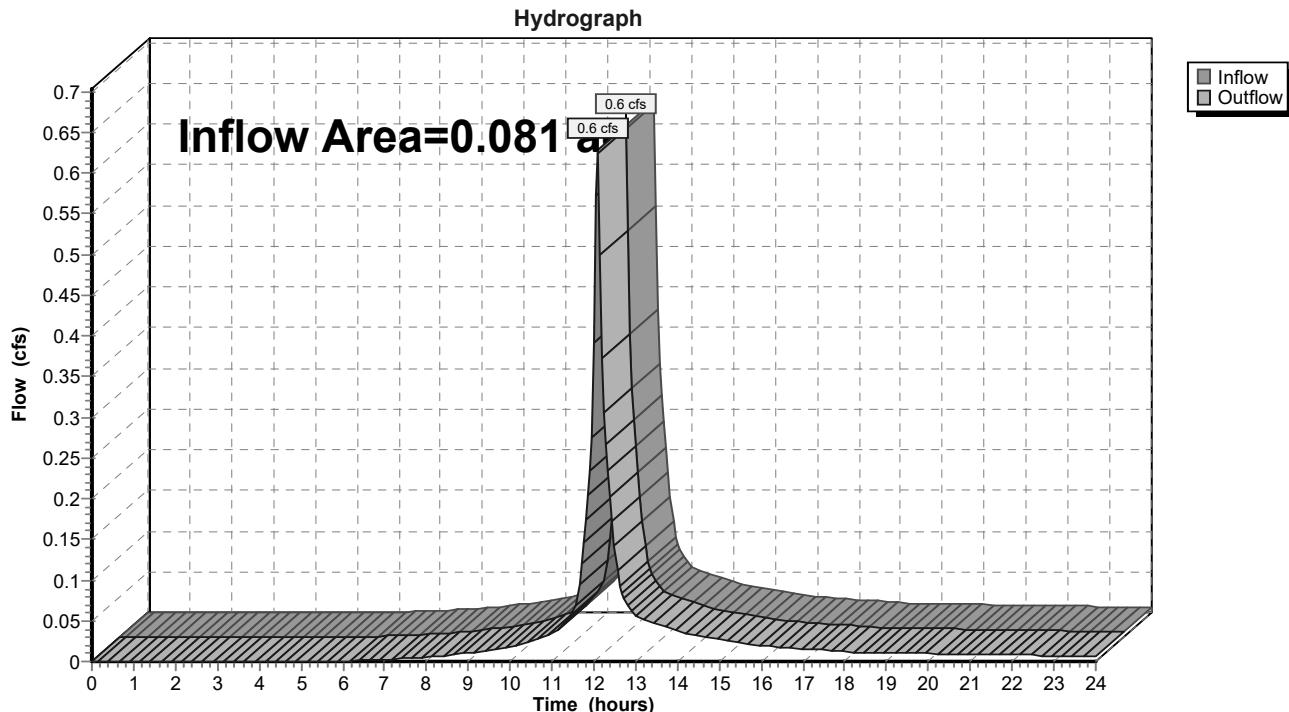
Inflow Area = 0.081 ac, 0.00% Impervious, Inflow Depth > 6.84" for 50-Yr 24 Hr event

Inflow = 0.6 cfs @ 12.09 hrs, Volume= 0.05 af

Outflow = 0.6 cfs @ 12.09 hrs, Volume= 0.05 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-3: Design Point 3



## Summary for Pond EX-D1: Existing Depression-1

Inflow Area = 0.261 ac, 15.47% Impervious, Inflow Depth > 2.82" for 50-Yr 24 Hr event  
 Inflow = 0.7 cfs @ 12.17 hrs, Volume= 0.06 af  
 Outflow = 0.6 cfs @ 12.25 hrs, Volume= 0.06 af, Atten= 3%, Lag= 4.7 min  
 Discarded = 0.0 cfs @ 12.25 hrs, Volume= 0.04 af  
 Primary = 0.6 cfs @ 12.25 hrs, Volume= 0.02 af

Routed to Pond EX-D2 : Existing Depression-2

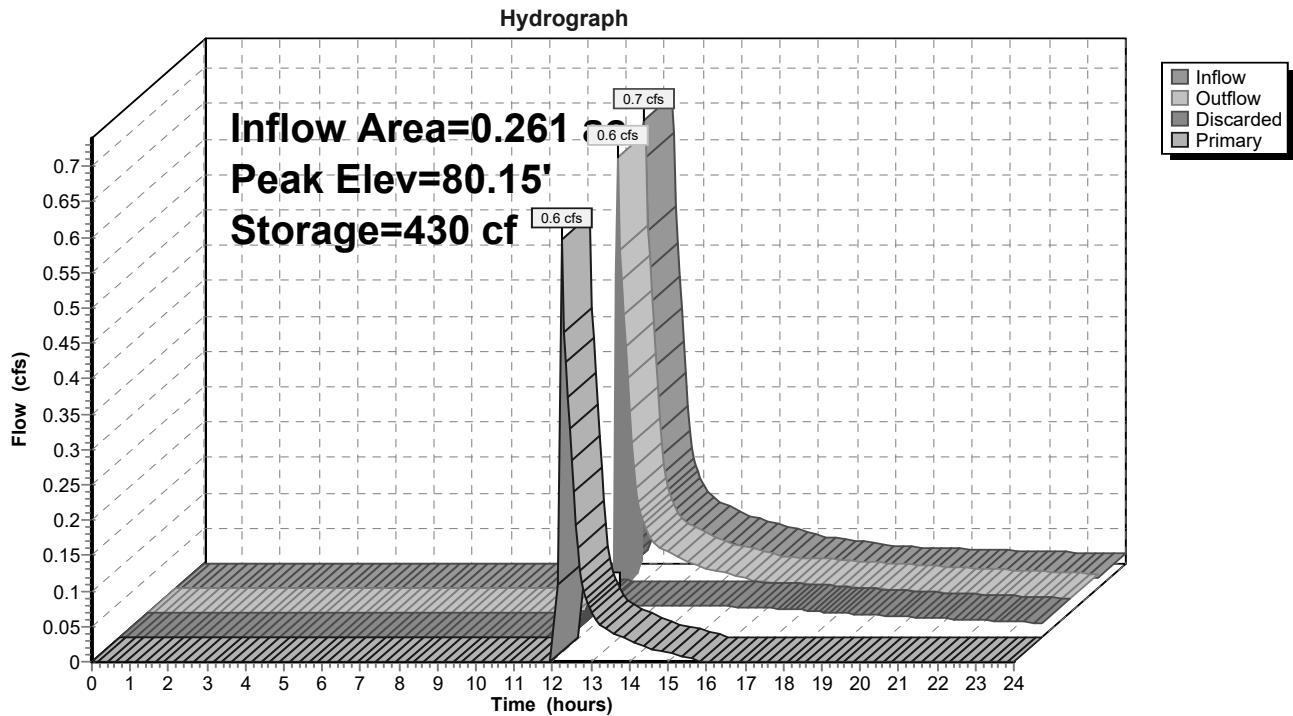
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 80.15' @ 12.25 hrs Surf.Area= 855 sf Storage= 430 cf

Plug-Flow detention time= 81.0 min calculated for 0.06 af (95% of inflow)  
 Center-of-Mass det. time= 55.8 min ( 927.7 - 872.0 )

Volume	Invert	Avail.Storage	Storage Description		
#1	78.80'	819 cf	<b>Custom Stage Data (Irregular)</b>	Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
78.80	32	25.0	0	0	32
79.00	64	46.0	9	9	151
80.00	648	104.0	305	315	847
80.50	1,421	148.0	505	819	1,732
Device	Routing	Invert	Outlet Devices		
#1	Primary	80.10'	<b>20.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b>		
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00		
			2.50 3.00 3.50 4.00 4.50 5.00 5.50		
			Coef. (English) 2.34 2.50 2.70 2.68 2.66 2.65 2.65 2.65		
			2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88		
#2	Discarded	78.80'	<b>2.410 in/hr Exfiltration over Surface area</b>		

**Discarded OutFlow** Max=0.0 cfs @ 12.25 hrs HW=80.15' (Free Discharge)  
 ↗ 2=Exfiltration (Exfiltration Controls 0.0 cfs)

**Primary OutFlow** Max=0.6 cfs @ 12.25 hrs HW=80.15' (Free Discharge)  
 ↗ 1=Broad-Crested Rectangular Weir (Weir Controls 0.6 cfs @ 0.5 fps)

**Pond EX-D1: Existing Depression-1**

## Summary for Pond EX-D2: Existing Depression-2

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth > 4.64" for 50-Yr 24 Hr event  
 Inflow = 4.3 cfs @ 12.12 hrs, Volume= 0.35 af  
 Outflow = 4.3 cfs @ 12.11 hrs, Volume= 0.35 af, Atten= 0%, Lag= 0.0 min  
 Discarded = 0.1 cfs @ 11.85 hrs, Volume= 0.07 af  
 Primary = 4.3 cfs @ 12.11 hrs, Volume= 0.28 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 76.74' @ 12.11 hrs Surf.Area= 1,120 sf Storage= 519 cf

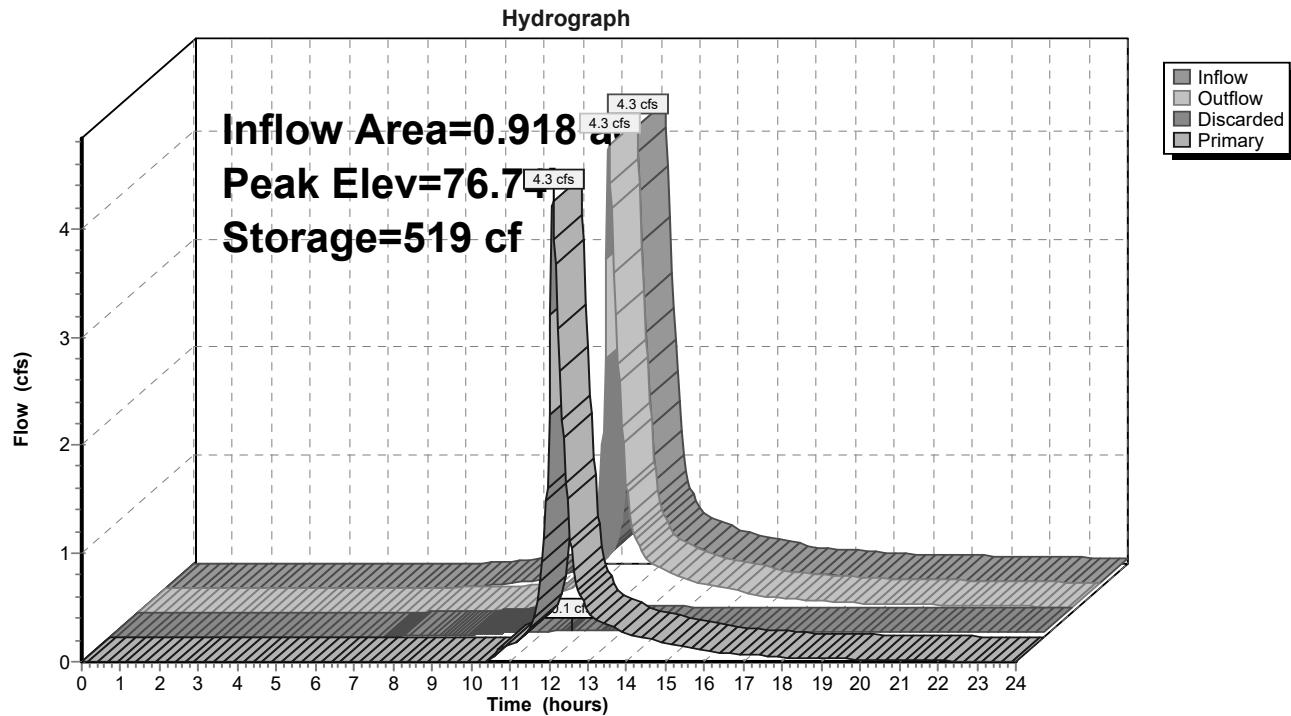
Plug-Flow detention time= 23.1 min calculated for 0.34 af (97% of inflow)  
 Center-of-Mass det. time= 7.9 min ( 820.7 - 812.8 )

Volume	Invert	Avail.Storage	Storage Description		
#1	75.60'	519 cf	<b>Custom Stage Data (Irregular)</b>	Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.60	172	80.0	0	0	172
76.00	345	115.0	101	101	717
76.60	1,120	212.0	417	519	3,243
Device	Routing	Invert	Outlet Devices		
#1	Primary	76.50'	<b>15.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b>		
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00		
			2.50 3.00 3.50 4.00 4.50 5.00 5.50		
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65		
			2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88		
#2	Discarded	75.60'	<b>2.410 in/hr Exfiltration over Surface area</b>		

**Discarded OutFlow** Max=0.1 cfs @ 11.85 hrs HW=76.60' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.1 cfs)

**Primary OutFlow** Max=4.1 cfs @ 12.11 hrs HW=76.74' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir (Weir Controls 4.1 cfs @ 1.2 fps)

## Pond EX-D2: Existing Depression-2



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentSC-1: Subcatchment1** Runoff Area=7,364 sf 45.00% Impervious Runoff Depth>7.01"  
Flow Length=52' Slope=0.0200 '/' Tc=6.0 min CN=66 Runoff=1.4 cfs 0.10 af

**SubcatchmentSC-2: Subcatchment2** Runoff Area=11,386 sf 15.47% Impervious Runoff Depth>4.00"  
Flow Length=212' Tc=11.4 min CN=46 Runoff=1.0 cfs 0.09 af

**SubcatchmentSC-2.1: Subcatchment2.1** Runoff Area=28,605 sf 42.28% Impervious Runoff Depth>7.72"  
Flow Length=225' Tc=8.2 min CN=71 Runoff=5.4 cfs 0.42 af

**SubcatchmentSC-3: Subcatchment3** Runoff Area=3,546 sf 0.00% Impervious Runoff Depth>8.55"  
Flow Length=57' Tc=6.0 min CN=77 Runoff=0.8 cfs 0.06 af

**Reach DP-1: Design Point 1** Inflow=1.4 cfs 0.10 af  
Outflow=1.4 cfs 0.10 af

**Reach DP-2: Design Point 2** Inflow=6.0 cfs 0.38 af  
Outflow=6.0 cfs 0.38 af

**Reach DP-3: Design Point 3** Inflow=0.8 cfs 0.06 af  
Outflow=0.8 cfs 0.06 af

**Pond EX-D1: Existing Depression-1** Peak Elev=80.18' Storage=450 cf Inflow=1.0 cfs 0.09 af  
Discarded=0.0 cfs 0.04 af Primary=1.0 cfs 0.04 af Outflow=1.0 cfs 0.08 af

**Pond EX-D2: Existing Depression-2** Peak Elev=76.80' Storage=519 cf Inflow=6.1 cfs 0.47 af  
Discarded=0.1 cfs 0.07 af Primary=6.0 cfs 0.38 af Outflow=6.1 cfs 0.46 af

**Total Runoff Area = 1.169 ac Runoff Volume = 0.67 af Average Runoff Depth = 6.84"**  
**66.27% Pervious = 0.774 ac 33.73% Impervious = 0.394 ac**

**Summary for Subcatchment SC-1: Subcatchment 1**

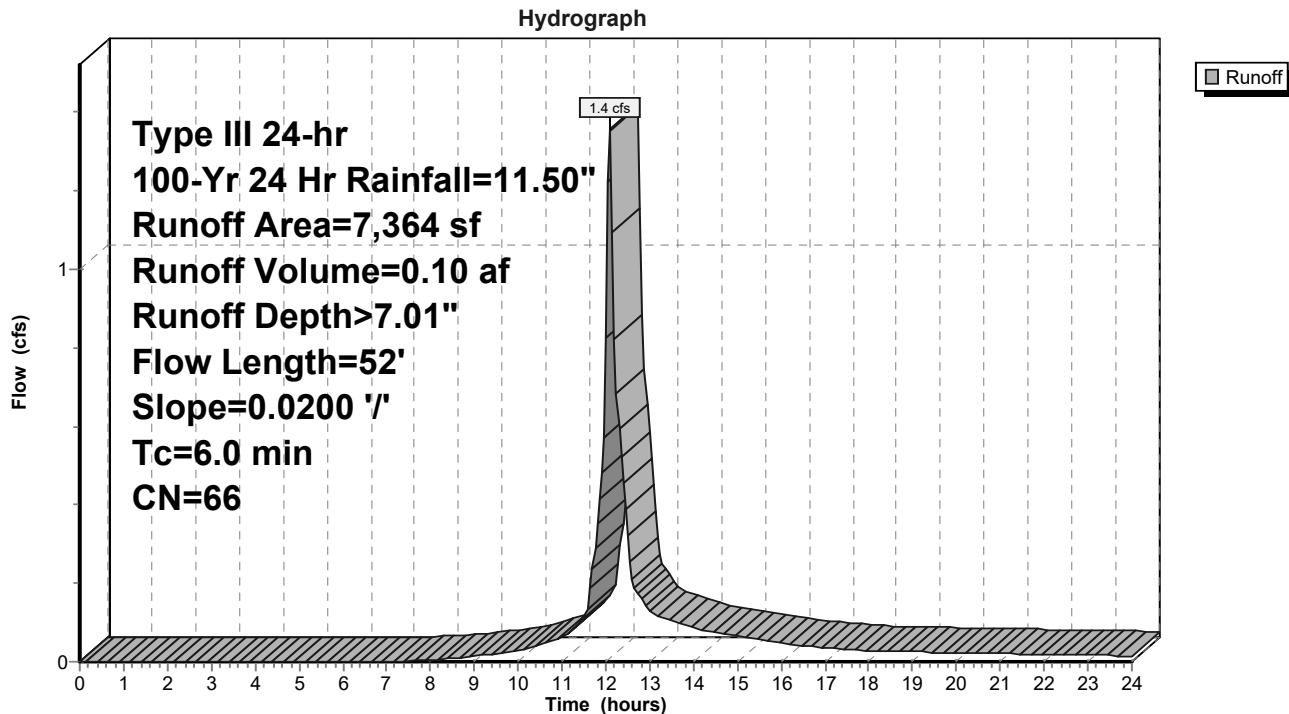
Runoff = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Depth> 7.01"  
Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
3,644	39	>75% Grass cover, Good, HSG A
*	1,684	Driveway/Walkways
*	1,412	Roof
*	218	Roof
	406	>75% Grass cover, Good, HSG A

7,364	66	Weighted Average
4,050		55.00% Pervious Area
3,314		45.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	24	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
0.4	26	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.04"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.8					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-1: Subcatchment 1**

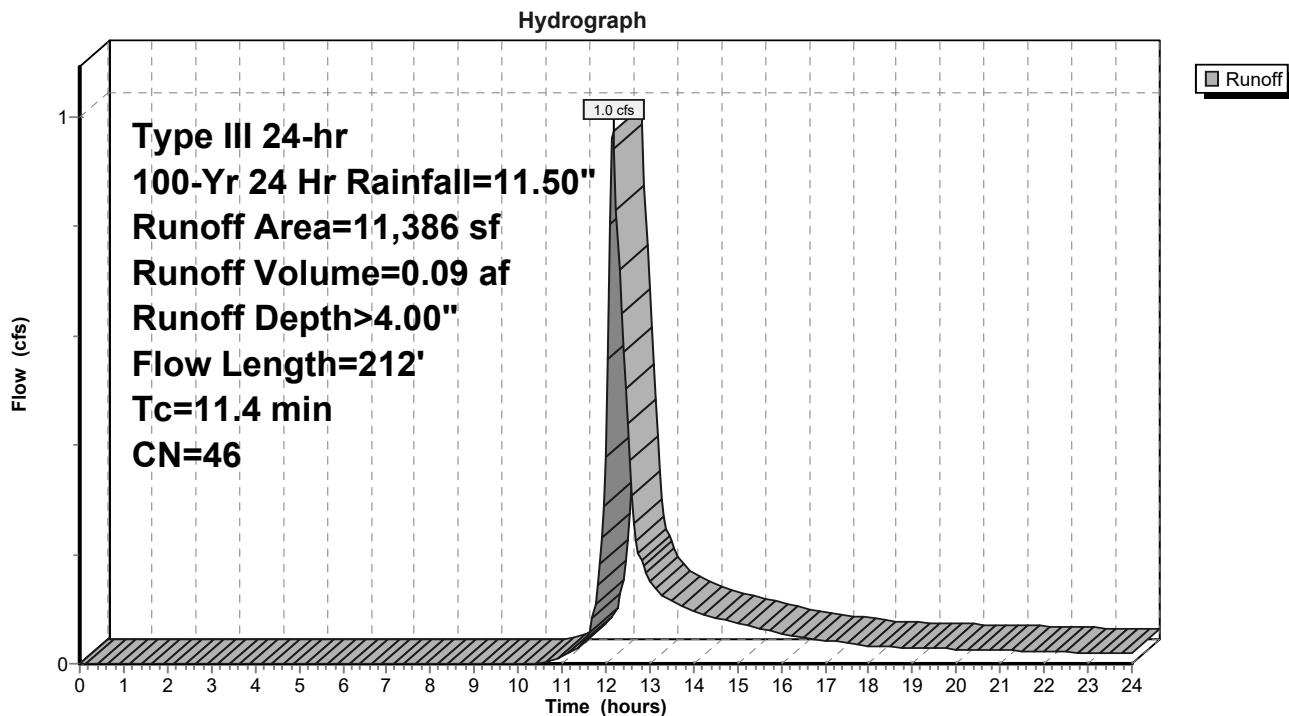
**Summary for Subcatchment SC-2: Subcatchment 2**

Runoff = 1.0 cfs @ 12.17 hrs, Volume= 0.09 af, Depth> 4.00"  
 Routed to Pond EX-D1 : Existing Depression-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
3,752	39	>75% Grass cover, Good, HSG A
23	77	Woods, Good, HSG D
*	811	Driveway/Walkways/Patios
*	735	Roof
3,208	30	Woods, Good, HSG A
*	23	Bulkheads
*	192	Shed
46	96	Gravel surface, HSG A
2,596	39	>75% Grass cover, Good, HSG A
11,386	46	Weighted Average
9,625		84.53% Pervious Area
1,761		15.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	21	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
7.1	29	0.0200	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.7	50	0.0600	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.8	76	0.1050	1.6		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.3	36	0.2000	2.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.4	212	Total			

**Subcatchment SC-2: Subcatchment 2**

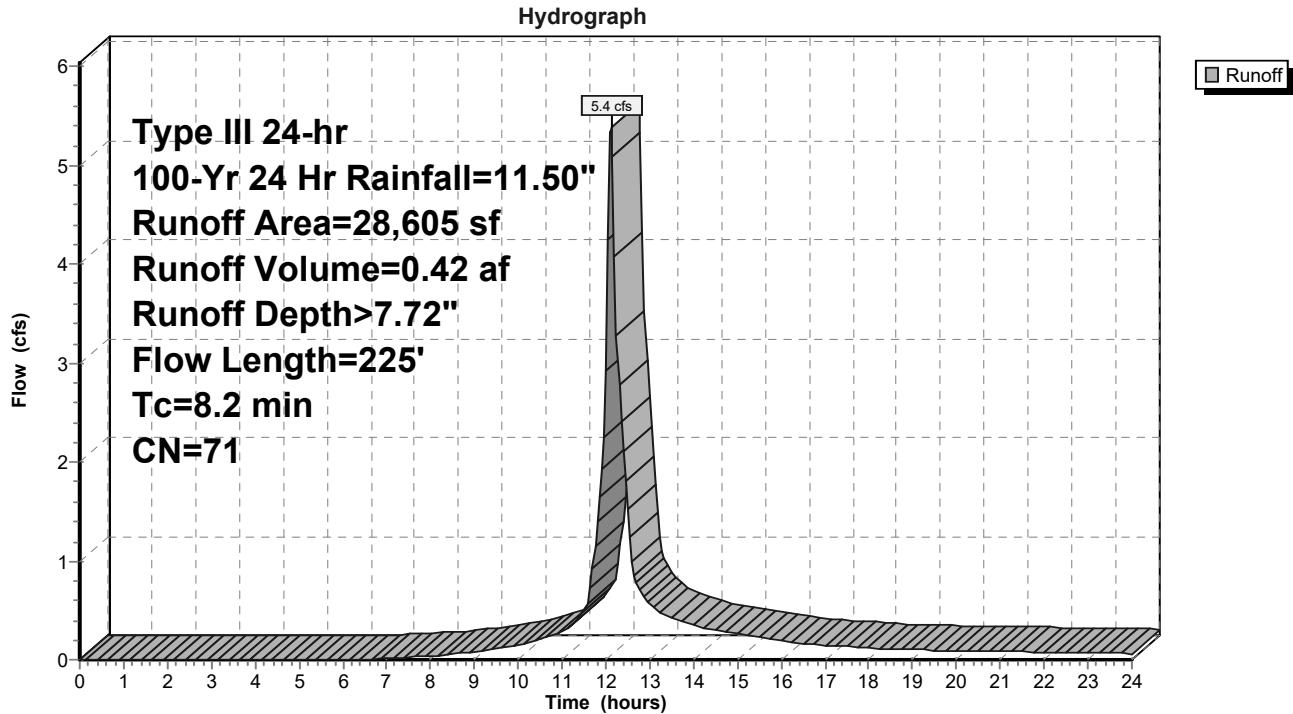
## Summary for Subcatchment SC-2.1: Subcatchment 2.1

Runoff = 5.4 cfs @ 12.12 hrs, Volume= 0.42 af, Depth> 7.72"  
 Routed to Pond EX-D2 : Existing Depression-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
0	39	>75% Grass cover, Good, HSG A
76	80	>75% Grass cover, Good, HSG D
5,371	77	Woods, Good, HSG D
*	9,310	Driveway/Walkways/Patios
*	2,765	Roof
4,626	30	Woods, Good, HSG A
*	20	Bulkheads
597	96	Gravel surface, HSG A
5,840	39	>75% Grass cover, Good, HSG A
28,605	71	Weighted Average
16,510		57.72% Pervious Area
12,095		42.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	41	0.0200	0.2		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.04"
1.8	9	0.0560	0.1		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
1.7	119	0.0560	1.2		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
0.4	56	0.2210	2.4		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
8.2	225	Total			

**Subcatchment SC-2.1: Subcatchment 2.1**

### Summary for Subcatchment SC-3: Subcatchment 3

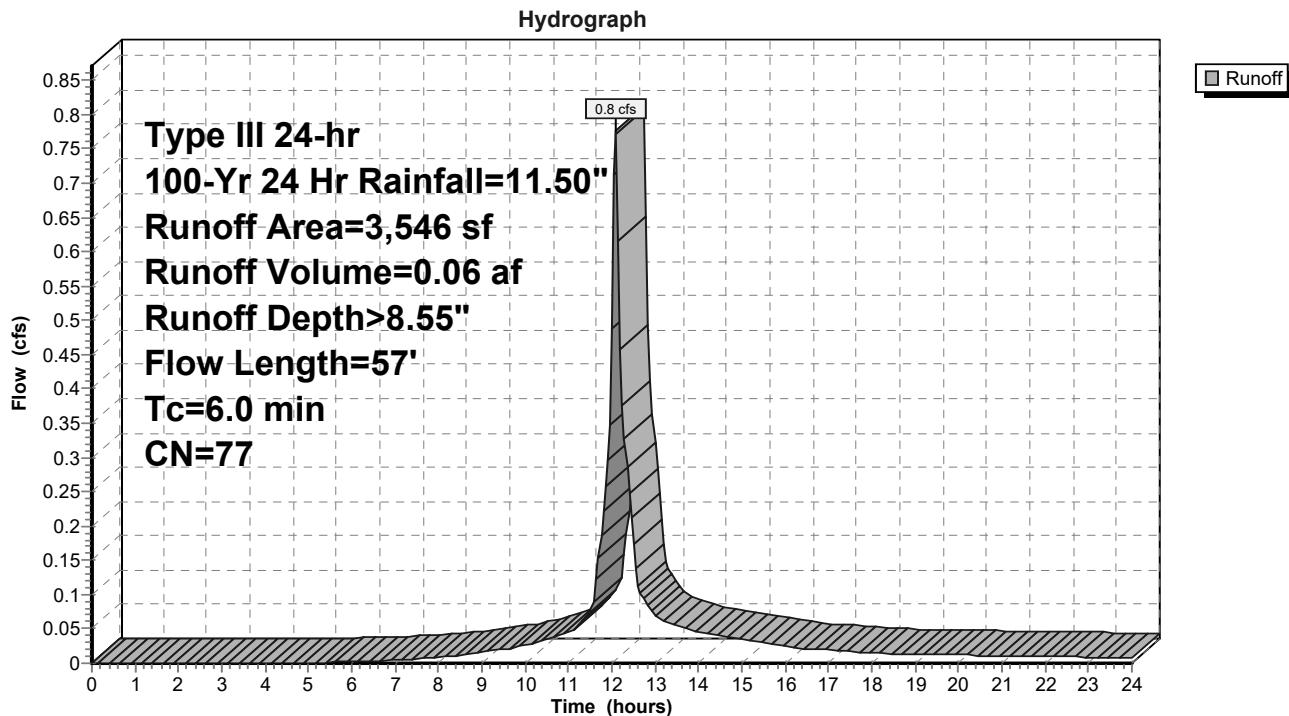
Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.06 af, Depth> 8.55"  
 Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
3,546	77	Woods, Good, HSG D
3,546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1170	0.2		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 4.04"
0.2	7	0.0200	0.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
5.6	57				Total, Increased to minimum Tc = 6.0 min

### Subcatchment SC-3: Subcatchment 3



### Summary for Reach DP-1: Design Point 1

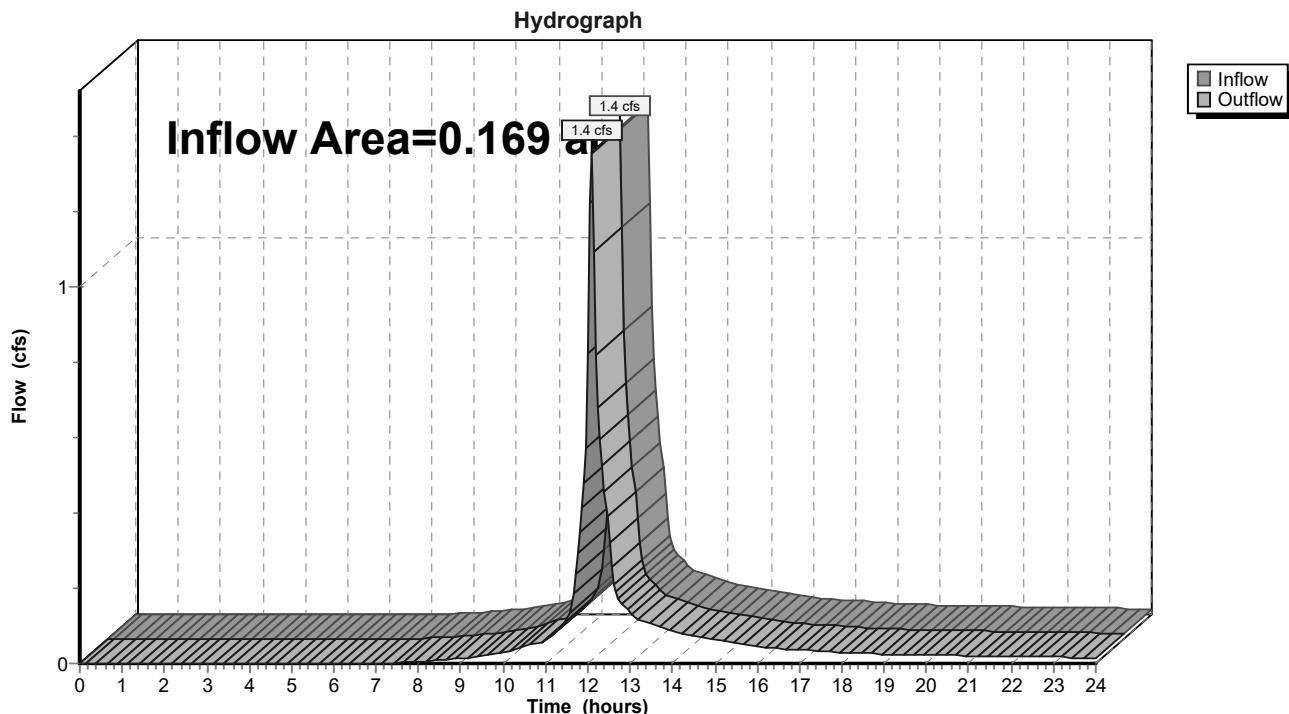
Inflow Area = 0.169 ac, 45.00% Impervious, Inflow Depth > 7.01" for 100-Yr 24 Hr event

Inflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af

Outflow = 1.4 cfs @ 12.09 hrs, Volume= 0.10 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-1: Design Point 1



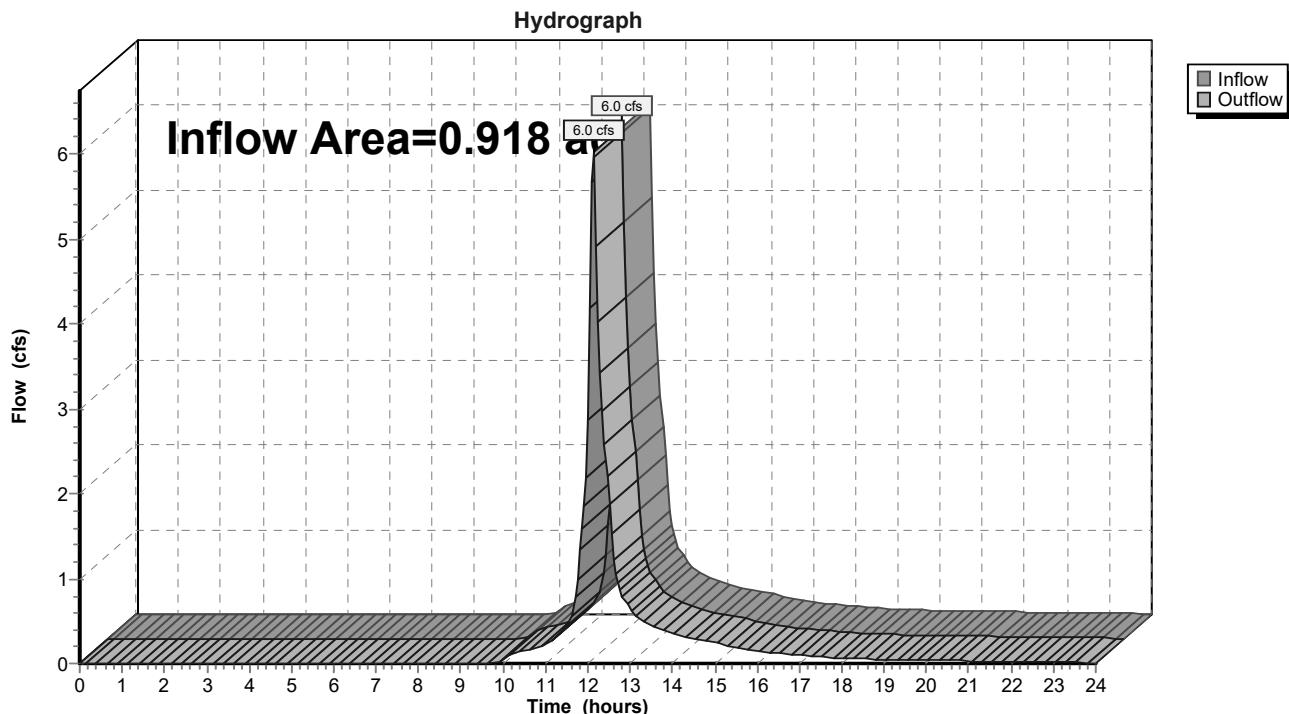
**Summary for Reach DP-2: Design Point 2**

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth &gt; 5.03" for 100-Yr 24 Hr event

Inflow = 6.0 cfs @ 12.14 hrs, Volume= 0.38 af

Outflow = 6.0 cfs @ 12.14 hrs, Volume= 0.38 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

**Reach DP-2: Design Point 2**

### Summary for Reach DP-3: Design Point 3

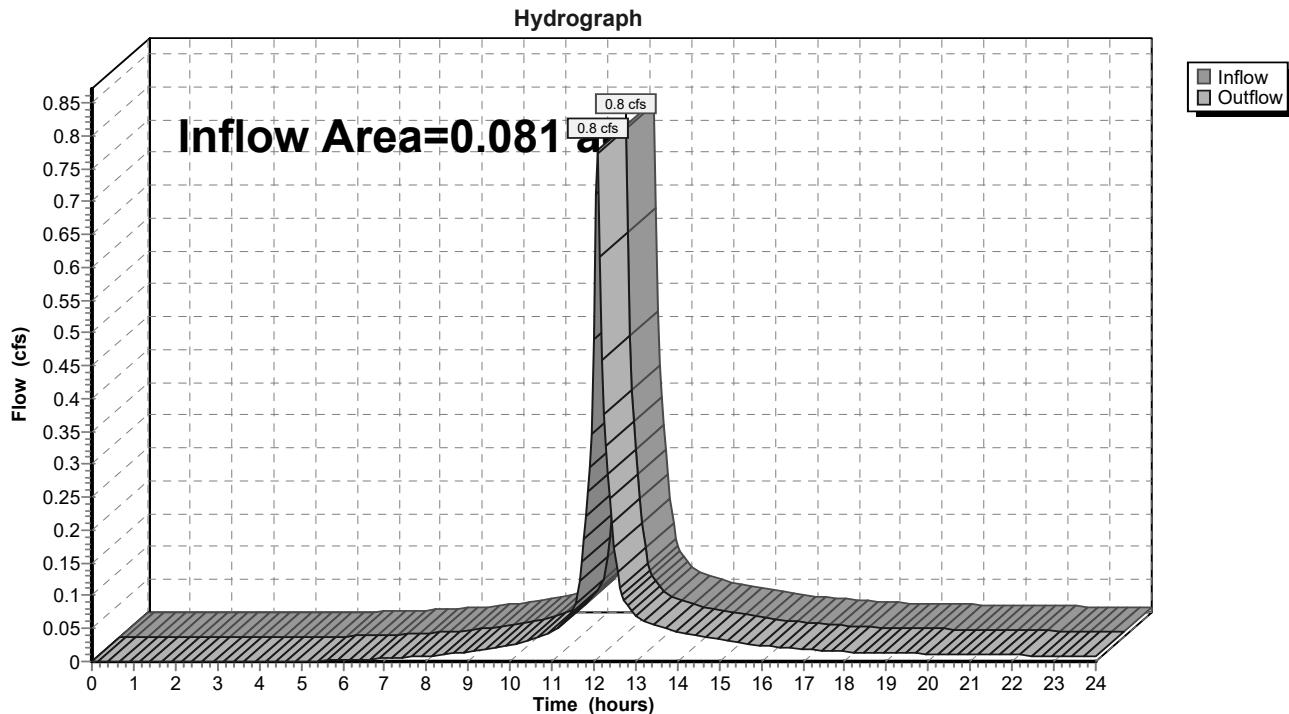
Inflow Area = 0.081 ac, 0.00% Impervious, Inflow Depth > 8.55" for 100-Yr 24 Hr event

Inflow = 0.8 cfs @ 12.09 hrs, Volume= 0.06 af

Outflow = 0.8 cfs @ 12.09 hrs, Volume= 0.06 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

### Reach DP-3: Design Point 3



## Summary for Pond EX-D1: Existing Depression-1

Inflow Area = 0.261 ac, 15.47% Impervious, Inflow Depth > 4.00" for 100-Yr 24 Hr event  
 Inflow = 1.0 cfs @ 12.17 hrs, Volume= 0.09 af  
 Outflow = 1.0 cfs @ 12.17 hrs, Volume= 0.08 af, Atten= 0%, Lag= 0.0 min  
 Discarded = 0.0 cfs @ 12.17 hrs, Volume= 0.04 af  
 Primary = 1.0 cfs @ 12.17 hrs, Volume= 0.04 af

Routed to Pond EX-D2 : Existing Depression-2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 80.18' @ 12.17 hrs Surf.Area= 888 sf Storage= 450 cf

Plug-Flow detention time= 63.9 min calculated for 0.08 af (95% of inflow)  
 Center-of-Mass det. time= 37.8 min ( 898.9 - 861.1 )

Volume	Invert	Avail.Storage	Storage Description							
#1	78.80'	819 cf	Custom Stage Data (Irregular)	Listed below (Recalc)						
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)					
78.80	32	25.0	0	0	32					
79.00	64	46.0	9	9	151					
80.00	648	104.0	305	315	847					
80.50	1,421	148.0	505	819	1,732					

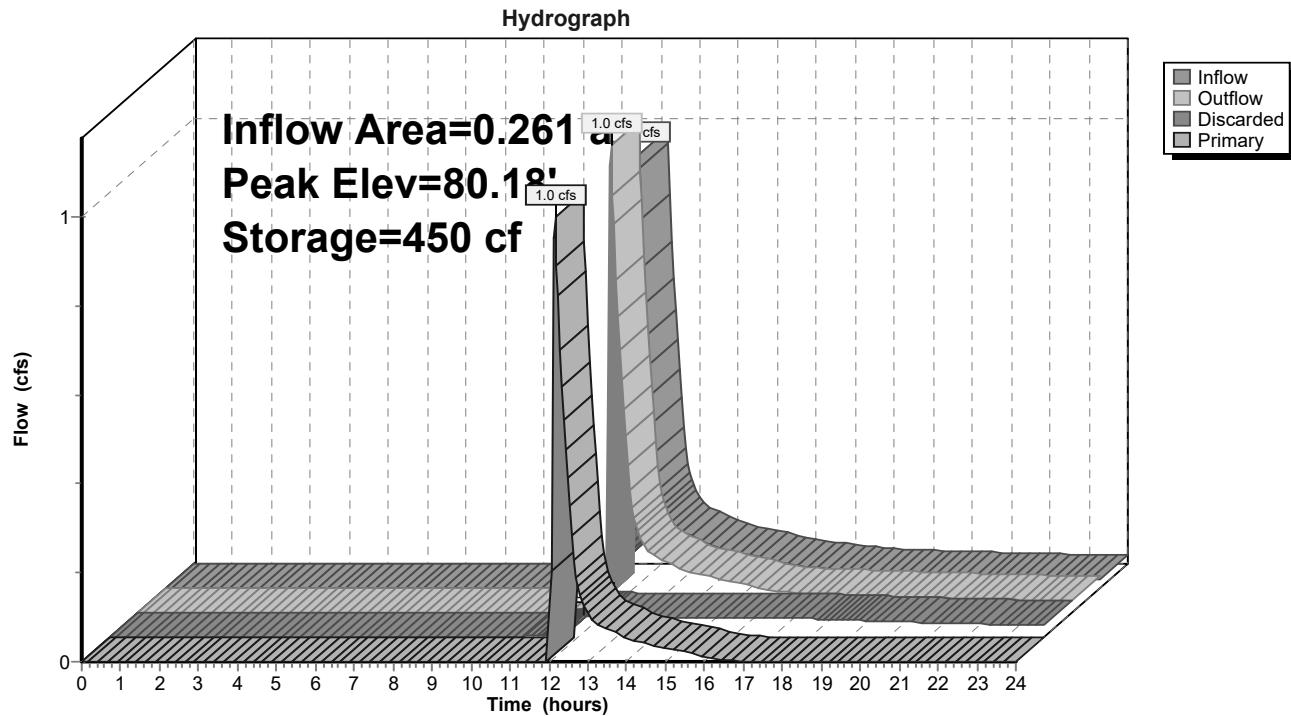
Device	Routing	Invert	Outlet Devices
#1	Primary	80.10'	<b>20.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	78.80'	<b>2.410 in/hr Exfiltration over Surface area</b>

Discarded OutFlow Max=0.0 cfs @ 12.17 hrs HW=80.17' (Free Discharge)

↑ 2=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.9 cfs @ 12.17 hrs HW=80.17' (Free Discharge)

↑ 1=Broad-Crested Rectangular Weir (Weir Controls 0.9 cfs @ 0.6 fps)

**Pond EX-D1: Existing Depression-1**

**Summary for Pond EX-D2: Existing Depression-2**

Inflow Area = 0.918 ac, 34.65% Impervious, Inflow Depth > 6.09" for 100-Yr 24 Hr event  
 Inflow = 6.1 cfs @ 12.14 hrs, Volume= 0.47 af  
 Outflow = 6.1 cfs @ 12.14 hrs, Volume= 0.46 af, Atten= 0%, Lag= 0.0 min  
 Discarded = 0.1 cfs @ 11.80 hrs, Volume= 0.07 af  
 Primary = 6.0 cfs @ 12.14 hrs, Volume= 0.38 af  
 Routed to Reach DP-2 : Design Point 2

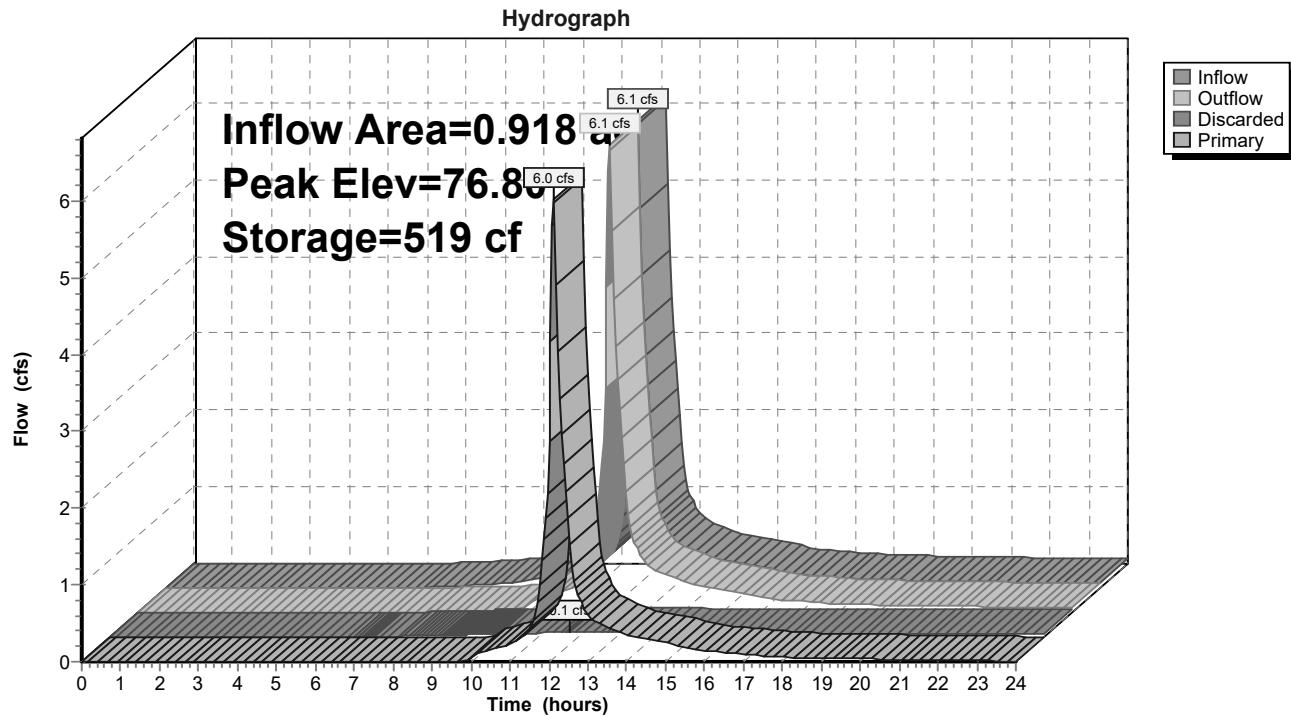
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
 Peak Elev= 76.80' @ 12.14 hrs Surf.Area= 1,120 sf Storage= 519 cf

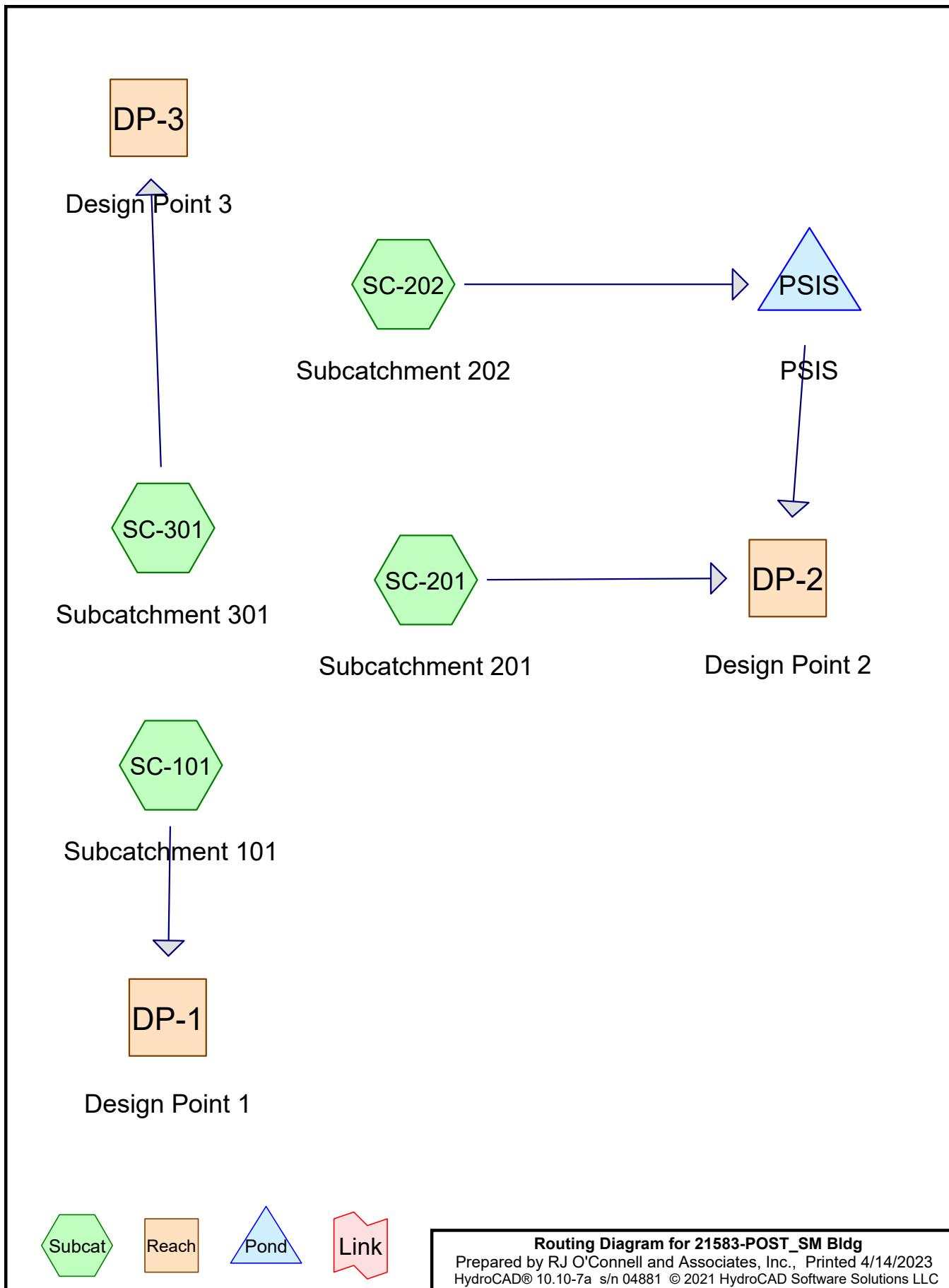
Plug-Flow detention time= 18.9 min calculated for 0.46 af (98% of inflow)  
 Center-of-Mass det. time= 6.7 min ( 812.3 - 805.6 )

Volume	Invert	Avail.Storage	Storage Description		
#1	75.60'	519 cf	<b>Custom Stage Data (Irregular)</b>	Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
75.60	172	80.0	0	0	172
76.00	345	115.0	101	101	717
76.60	1,120	212.0	417	519	3,243
Device	Routing	Invert	Outlet Devices		
#1	Primary	76.50'	<b>15.0' long x 5.0' breadth Broad-Crested Rectangular Weir</b>		
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00		
			2.50 3.00 3.50 4.00 4.50 5.00 5.50		
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65		
			2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88		
#2	Discarded	75.60'	<b>2.410 in/hr Exfiltration over Surface area</b>		

**Discarded OutFlow** Max=0.1 cfs @ 11.80 hrs HW=76.61' (Free Discharge)  
 ↑ 2=Exfiltration (Exfiltration Controls 0.1 cfs)

**Primary OutFlow** Max=5.9 cfs @ 12.14 hrs HW=76.80' (Free Discharge)  
 ↑ 1=Broad-Crested Rectangular Weir (Weir Controls 5.9 cfs @ 1.3 fps)

**Pond EX-D2: Existing Depression-2**



**21583-POST\_SM Bldg**

Prepared by RJ O'Connell and Associates, Inc.

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Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.226	39	>75% Grass cover, Good, HSG A (SC-101, SC-201, SC-202)
0.262	80	>75% Grass cover, Good, HSG D (SC-201, SC-202, SC-301)
0.017	98	Existing Roof (SC-101, SC-201)
0.016	98	Proposed Bit. Conc. Walkway (SC-202)
0.051	98	Proposed Driveway (SC-101)
0.560	98	Proposed Roof Area (SC-202)
0.035	96	Proposed Stone Dust Walkway (SC-201, SC-202)
<b>1.169</b>	<b>82</b>	<b>TOTAL AREA</b>

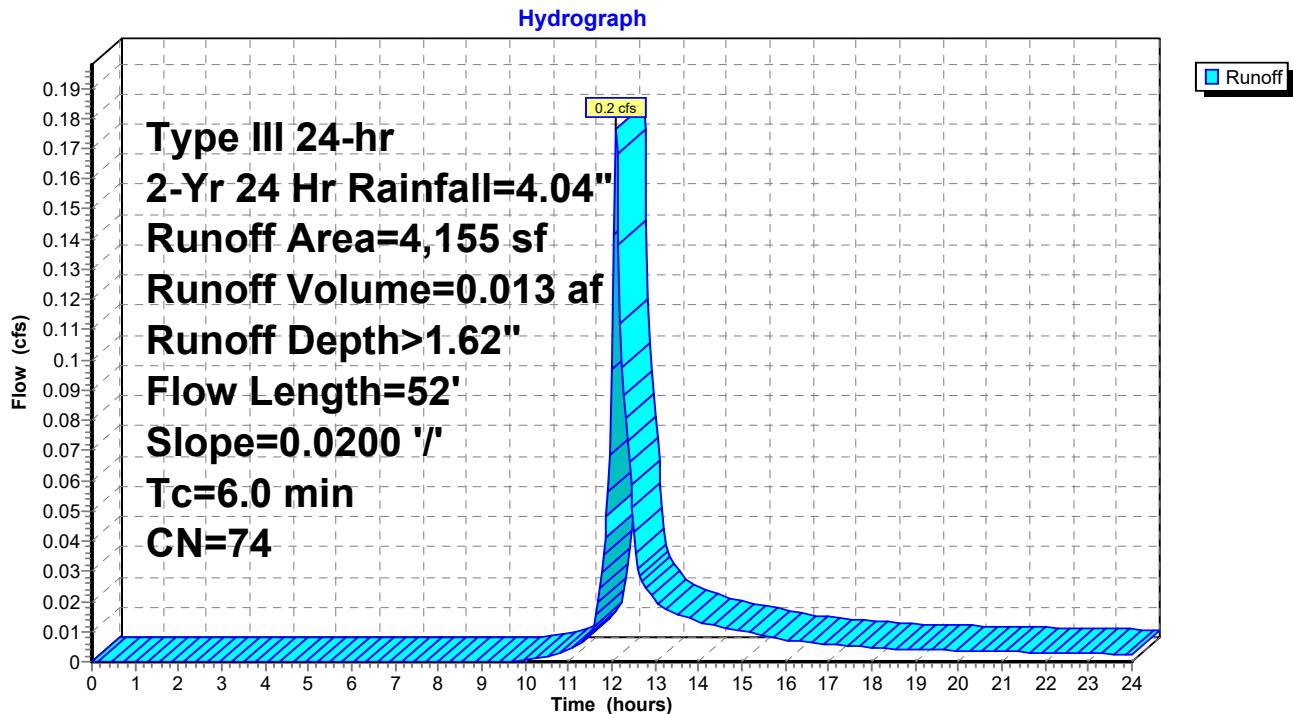
### Summary for Subcatchment SC-101: Subcatchment 101

Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af, Depth> 1.62"  
 Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
1,288	39	>75% Grass cover, Good, HSG A
*	2,243	Proposed Driveway
*	218	Existing Roof
	406	>75% Grass cover, Good, HSG A
4,155	74	Weighted Average
1,694		40.77% Pervious Area
2,461		59.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	25	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
0.4	25	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.01"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.7					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-101: Subcatchment 101**

### Summary for Subcatchment SC-201: Subcatchment 201

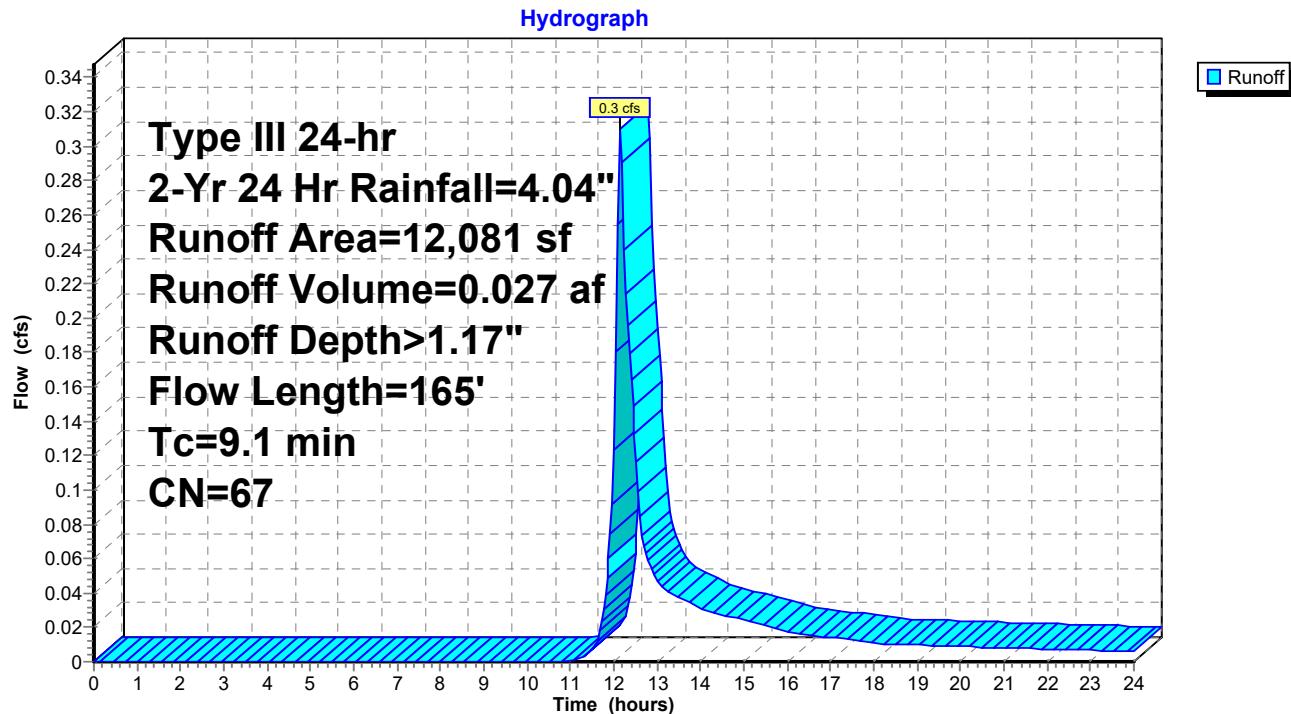
Runoff = 0.3 cfs @ 12.14 hrs, Volume= 0.027 af, Depth> 1.17"  
 Routed to Reach DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
4,295	39	>75% Grass cover, Good, HSG A
*	791	Proposed Stone Dust Walkway
6,455	80	>75% Grass cover, Good, HSG D
*	218	Existing Roof
*	322	Existing Roof

12,081	67	Weighted Average
11,541		95.53% Pervious Area
540		4.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0570	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
4.8	89	0.0700	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
1.0	26	0.3300	0.4		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
9.1	165	Total			

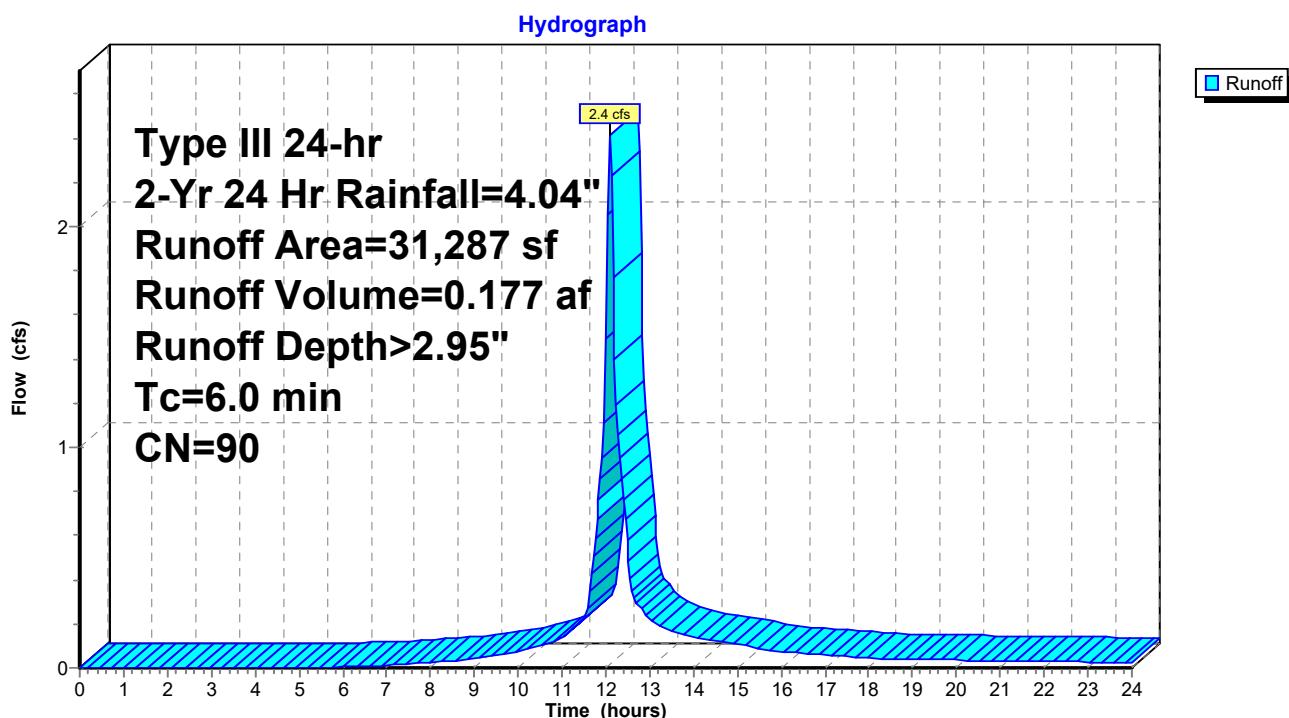
**Subcatchment SC-201: Subcatchment 201**

**Summary for Subcatchment SC-202: Subcatchment 202**

Runoff = 2.4 cfs @ 12.09 hrs, Volume= 0.177 af, Depth> 2.95"  
 Routed to Pond PSIS : PSIS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description			
* 24,400	98	Proposed Roof Area			
3,872	39	>75% Grass cover, Good, HSG A			
1,583	80	>75% Grass cover, Good, HSG D			
* 720	96	Proposed Stone Dust Walkway			
* 712	98	Proposed Bit. Conc. Walkway			
31,287	90	Weighted Average			
6,175		19.74% Pervious Area			
25,112		80.26% Impervious Area			
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
6.0					Direct Entry, Min. Engineering Standard

**Subcatchment SC-202: Subcatchment 202**

### Summary for Subcatchment SC-301: Subcatchment 301

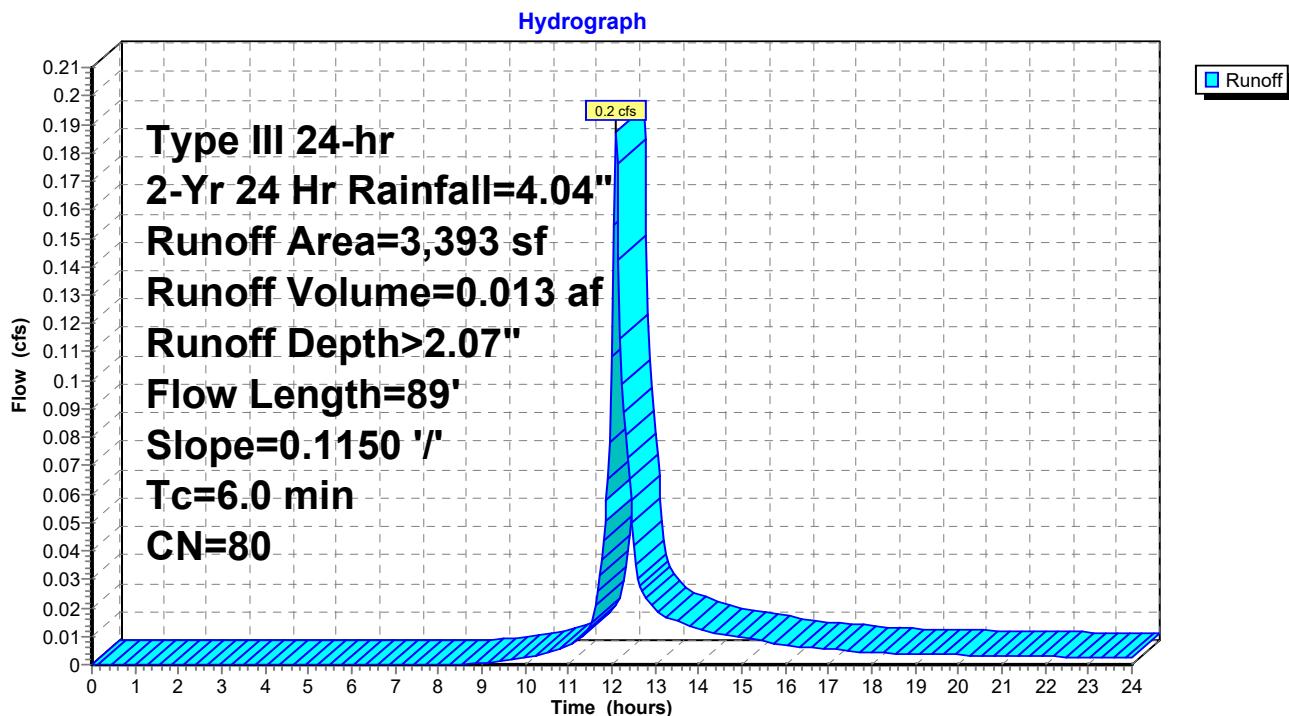
Runoff = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af, Depth> 2.07"  
 Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 2-Yr 24 Hr Rainfall=4.04"

Area (sf)	CN	Description
3,393	80	>75% Grass cover, Good, HSG D
3,393		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1150	0.2		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 4.01"
0.4	39	0.1150	1.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.0					<b>Direct Entry, Min. Engineering Practice</b>
6.0	89	Total			

### Subcatchment SC-301: Subcatchment 301



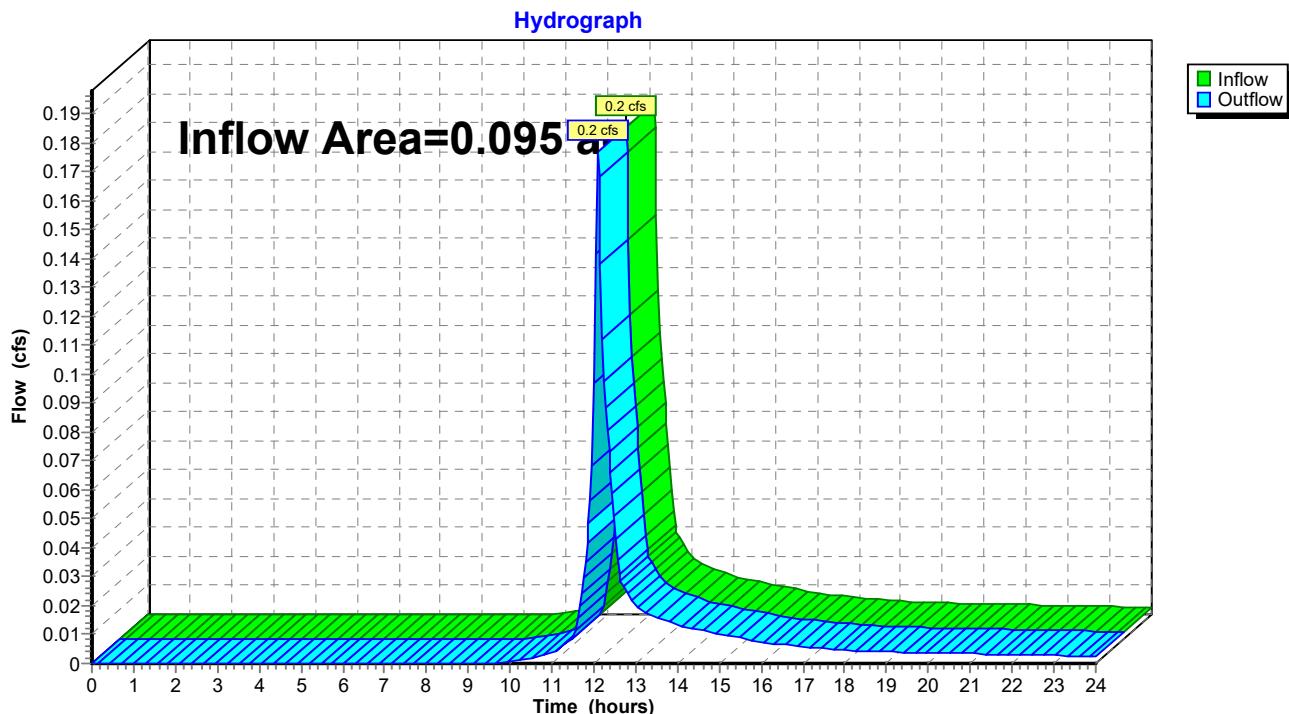
**Summary for Reach DP-1: Design Point 1**

Inflow Area = 0.095 ac, 59.23% Impervious, Inflow Depth &gt; 1.62" for 2-Yr 24 Hr event

Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af

Outflow = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-1: Design Point 1**

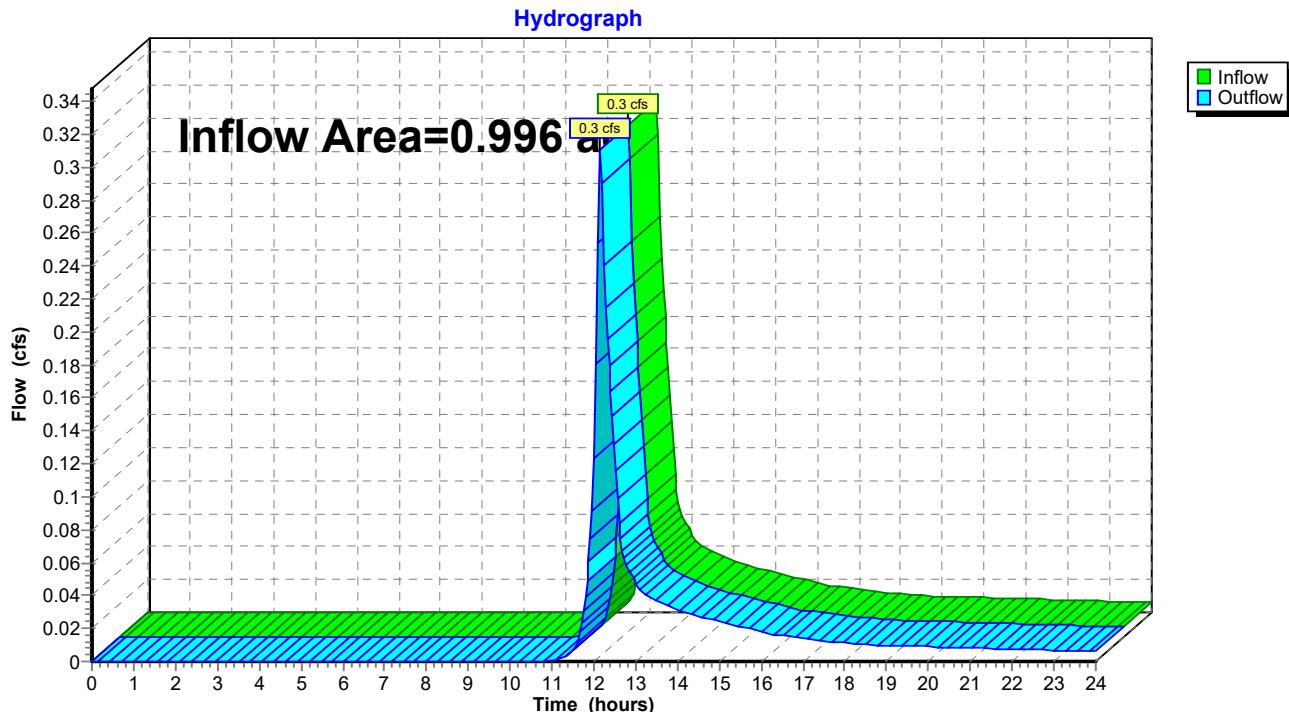
**Summary for Reach DP-2: Design Point 2**

Inflow Area = 0.996 ac, 59.15% Impervious, Inflow Depth &gt; 0.33" for 2-Yr 24 Hr event

Inflow = 0.3 cfs @ 12.14 hrs, Volume= 0.027 af

Outflow = 0.3 cfs @ 12.14 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-2: Design Point 2**

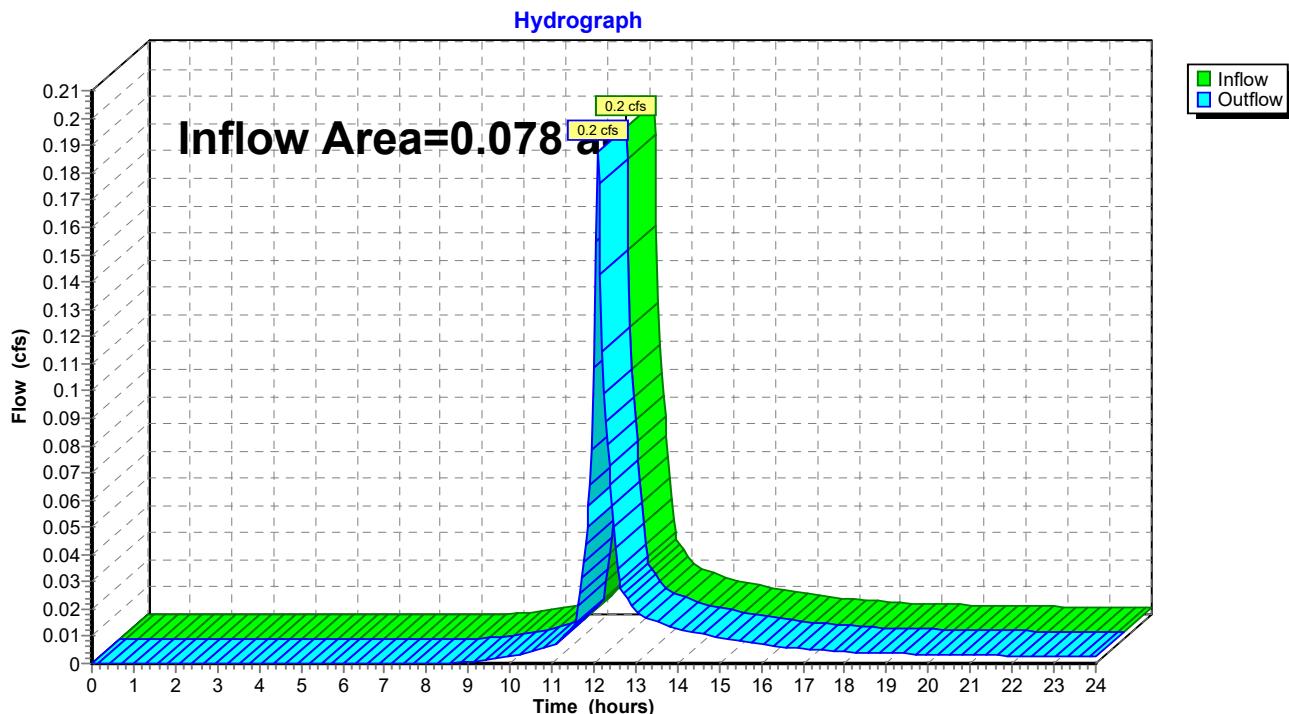
**Summary for Reach DP-3: Design Point 3**

Inflow Area = 0.078 ac, 0.00% Impervious, Inflow Depth &gt; 2.07" for 2-Yr 24 Hr event

Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af

Outflow = 0.2 cfs @ 12.09 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-3: Design Point 3**

### Summary for Pond PSIS: PSIS

Inflow Area = 0.718 ac, 80.26% Impervious, Inflow Depth > 2.95" for 2-Yr 24 Hr event  
 Inflow = 2.4 cfs @ 12.09 hrs, Volume= 0.177 af  
 Outflow = 0.2 cfs @ 11.36 hrs, Volume= 0.177 af, Atten= 93%, Lag= 0.0 min  
 Discarded = 0.2 cfs @ 11.36 hrs, Volume= 0.177 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Peak Elev= 83.25' @ 13.59 hrs Surf.Area= 2,958 sf Storage= 3,312 cf

Plug-Flow detention time= 175.3 min calculated for 0.176 af (100% of inflow)  
 Center-of-Mass det. time= 174.0 min ( 971.7 - 797.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	81.50'	5,019 cf	<b>83.00'W x 35.64'L x 6.75'H Field A</b> 19,968 cf Overall - 7,420 cf Embedded = 12,548 cf x 40.0% Voids
#2A	82.25'	7,420 cf	<b>ADS_StormTech MC-4500 b +Capx 63 Inside #1</b> Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 63 Chambers in 9 Rows Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf
12,439 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	81.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	86.67'	<b>6.0" Vert. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#3	Primary	86.67'	<b>12.0" Round Culvert</b> L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.67' / 86.50' S= 0.0340 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.2 cfs @ 11.36 hrs HW=81.57' (Free Discharge)  
 ↑ 1=Exfiltration (Exfiltration Controls 0.2 cfs)

**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=81.50' (Free Discharge)  
 ↑ 3=Culvert ( Controls 0.0 cfs)  
 ↑ 2=Orifice/Grate ( Controls 0.0 cfs)

**Pond PSIS: PSIS - Chamber Wizard Field A****Chamber Model = ADS\_StormTechMC-4500 b +Cap (ADS StormTech®MC-4500 with cap volume)**

Effective Size= 90.4"W x 60.0"H =&gt; 26.46 sf x 4.03'L = 106.5 cf

Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap

Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

7 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 33.64' Row Length +12.0" End Stone x 2 = 35.64'  
Base Length

9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width

9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

63 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 9 Rows = 7,419.9 cf Chamber Storage

19,968.2 cf Field - 7,419.9 cf Chambers = 12,548.3 cf Stone x 40.0% Voids = 5,019.3 cf Stone Storage

Chamber Storage + Stone Storage = 12,439.2 cf = 0.286 af

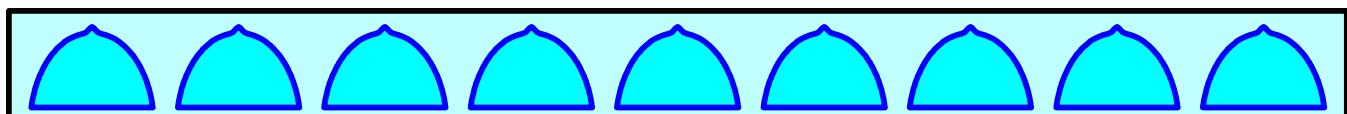
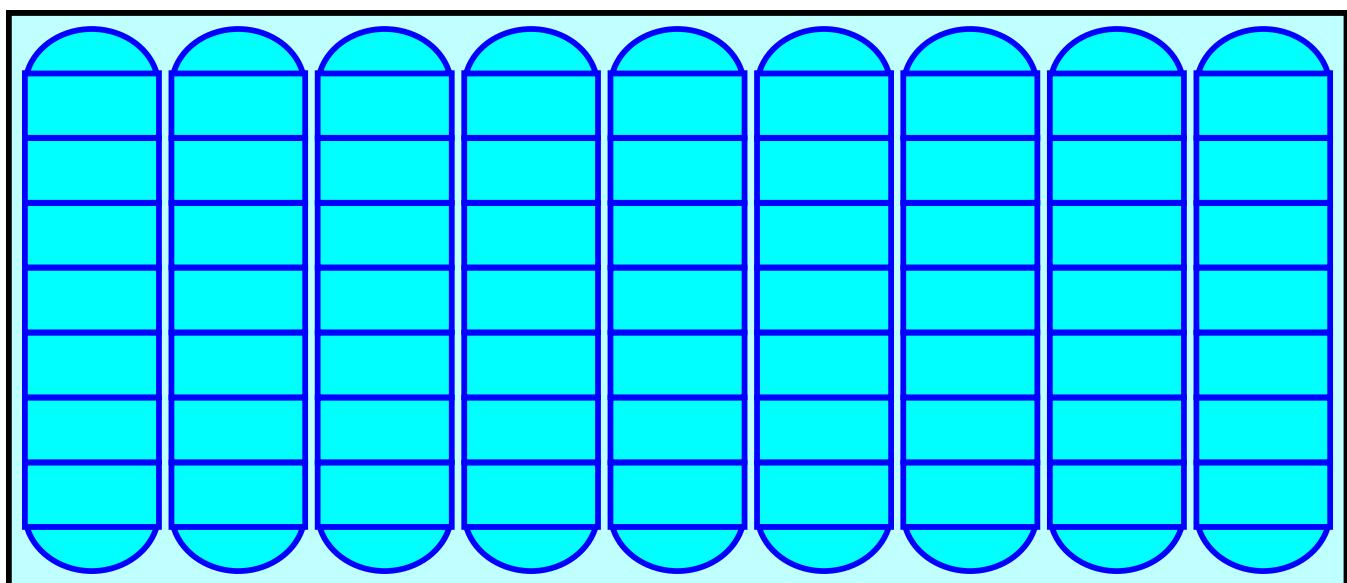
Overall Storage Efficiency = 62.3%

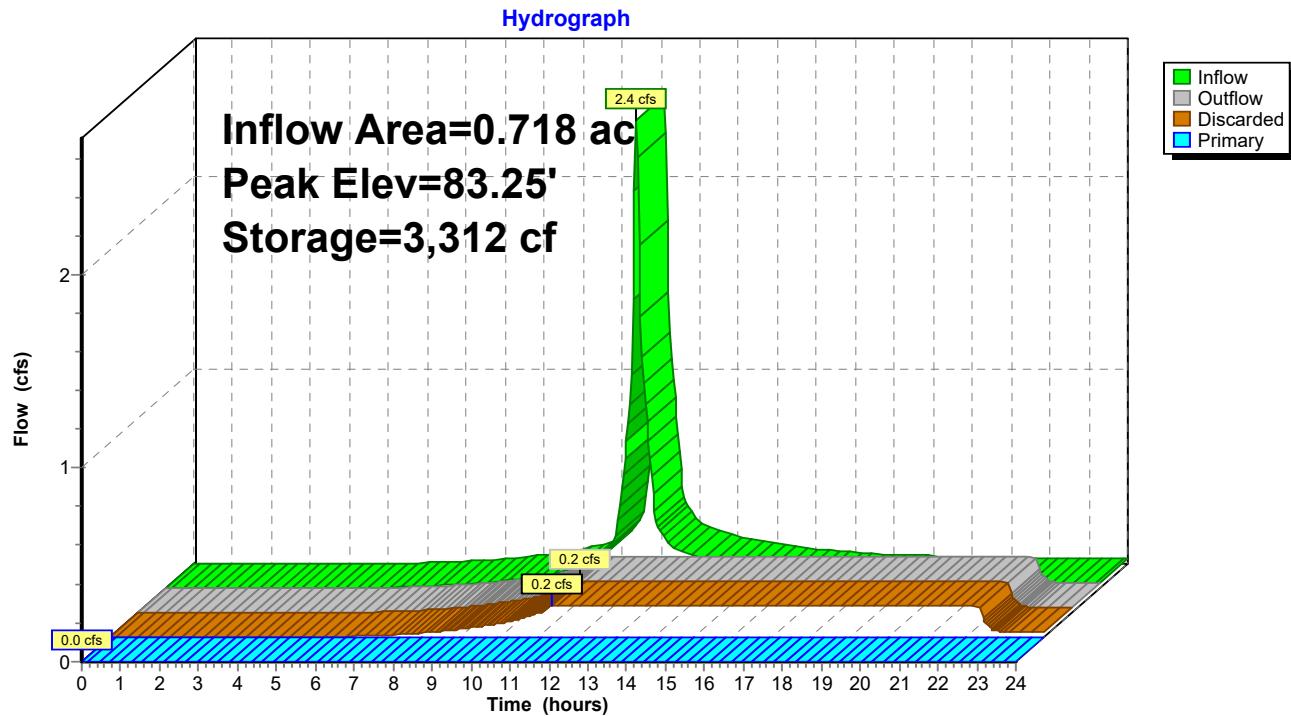
Overall System Size = 35.64' x 83.00' x 6.75'

63 Chambers

739.6 cy Field

464.8 cy Stone



**Pond PSIS: PSIS**

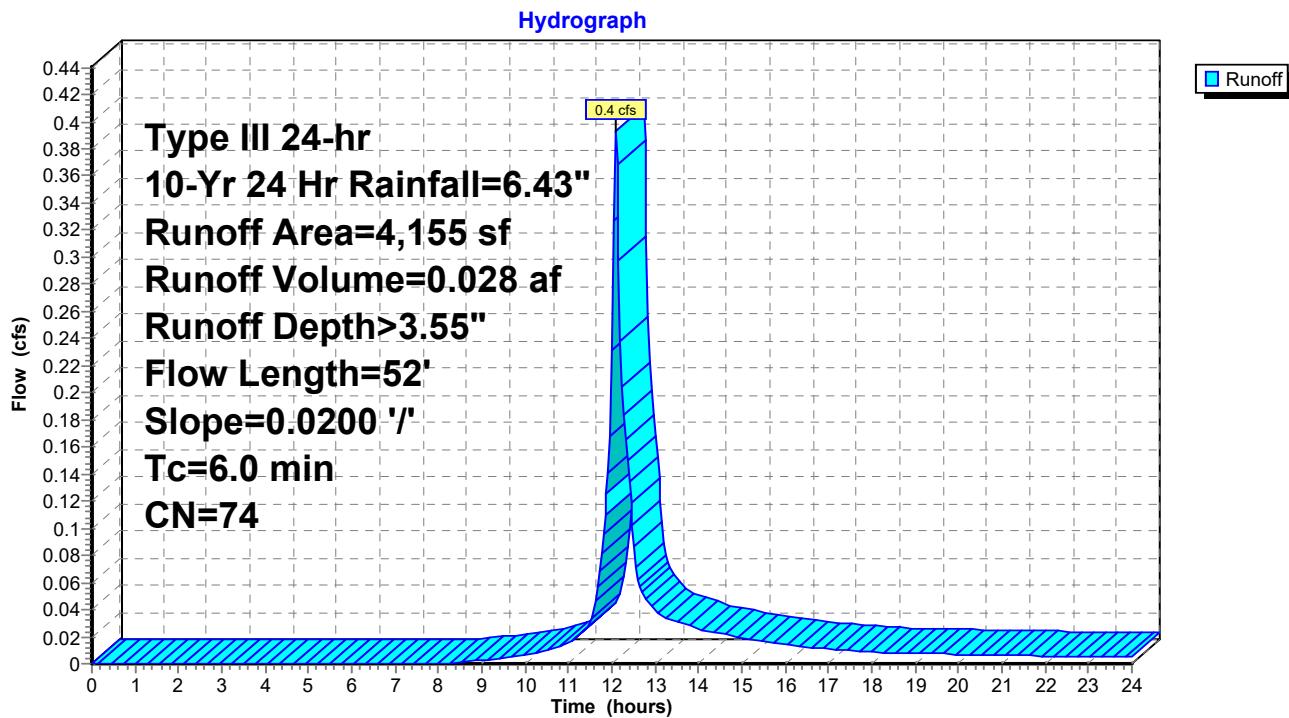
### Summary for Subcatchment SC-101: Subcatchment 101

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.028 af, Depth> 3.55"  
 Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
1,288	39	>75% Grass cover, Good, HSG A
*	2,243	Proposed Driveway
*	218	Existing Roof
406	39	>75% Grass cover, Good, HSG A
4,155	74	Weighted Average
1,694		40.77% Pervious Area
2,461		59.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	25	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
0.4	25	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.01"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.7					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-101: Subcatchment 101**

### Summary for Subcatchment SC-201: Subcatchment 201

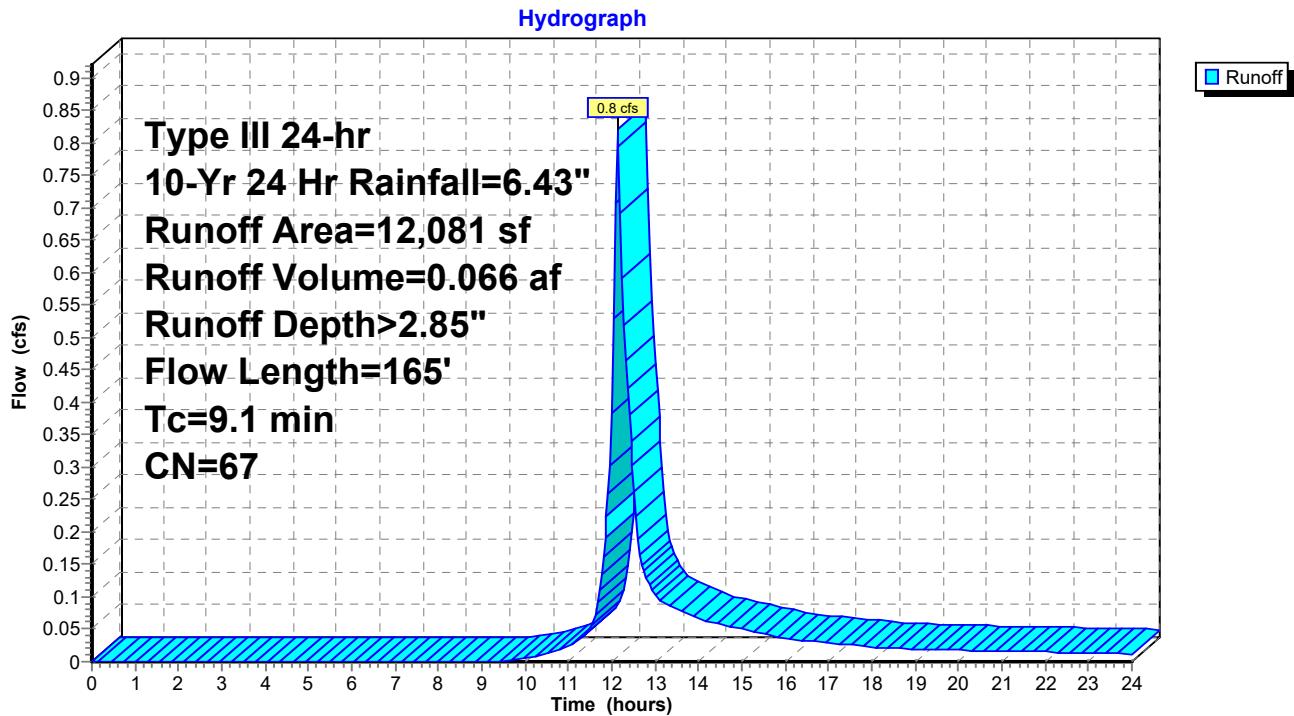
Runoff = 0.8 cfs @ 12.13 hrs, Volume= 0.066 af, Depth> 2.85"  
 Routed to Reach DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
4,295	39	>75% Grass cover, Good, HSG A
*	791	Proposed Stone Dust Walkway
6,455	80	>75% Grass cover, Good, HSG D
*	218	Existing Roof
*	322	Existing Roof

12,081	67	Weighted Average
11,541		95.53% Pervious Area
540		4.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0570	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
4.8	89	0.0700	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
1.0	26	0.3300	0.4		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
9.1	165	Total			

**Subcatchment SC-201: Subcatchment 201**

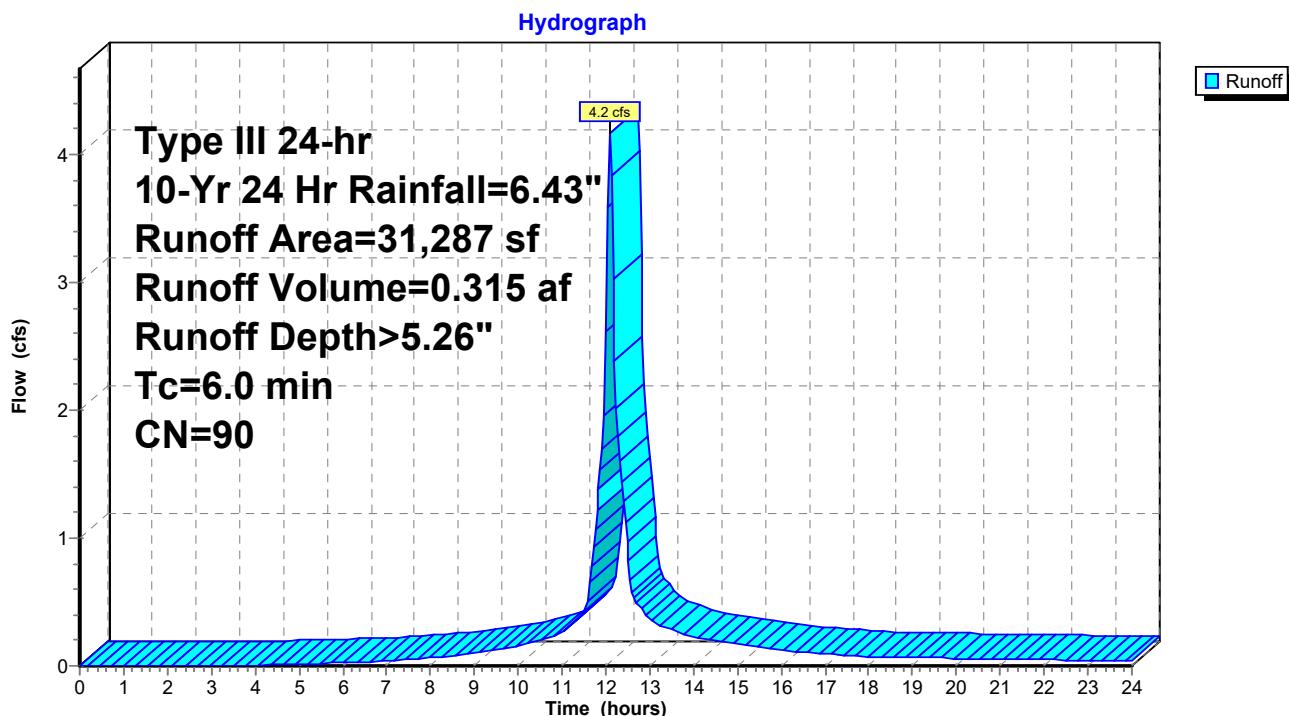
### Summary for Subcatchment SC-202: Subcatchment 202

Runoff = 4.2 cfs @ 12.09 hrs, Volume= 0.315 af, Depth> 5.26"  
 Routed to Pond PSIS : PSIS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description			
* 24,400	98	Proposed Roof Area			
3,872	39	>75% Grass cover, Good, HSG A			
1,583	80	>75% Grass cover, Good, HSG D			
* 720	96	Proposed Stone Dust Walkway			
* 712	98	Proposed Bit. Conc. Walkway			
31,287	90	Weighted Average			
6,175		19.74% Pervious Area			
25,112		80.26% Impervious Area			
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
6.0					Direct Entry, Min. Engineering Standard

### Subcatchment SC-202: Subcatchment 202



### Summary for Subcatchment SC-301: Subcatchment 301

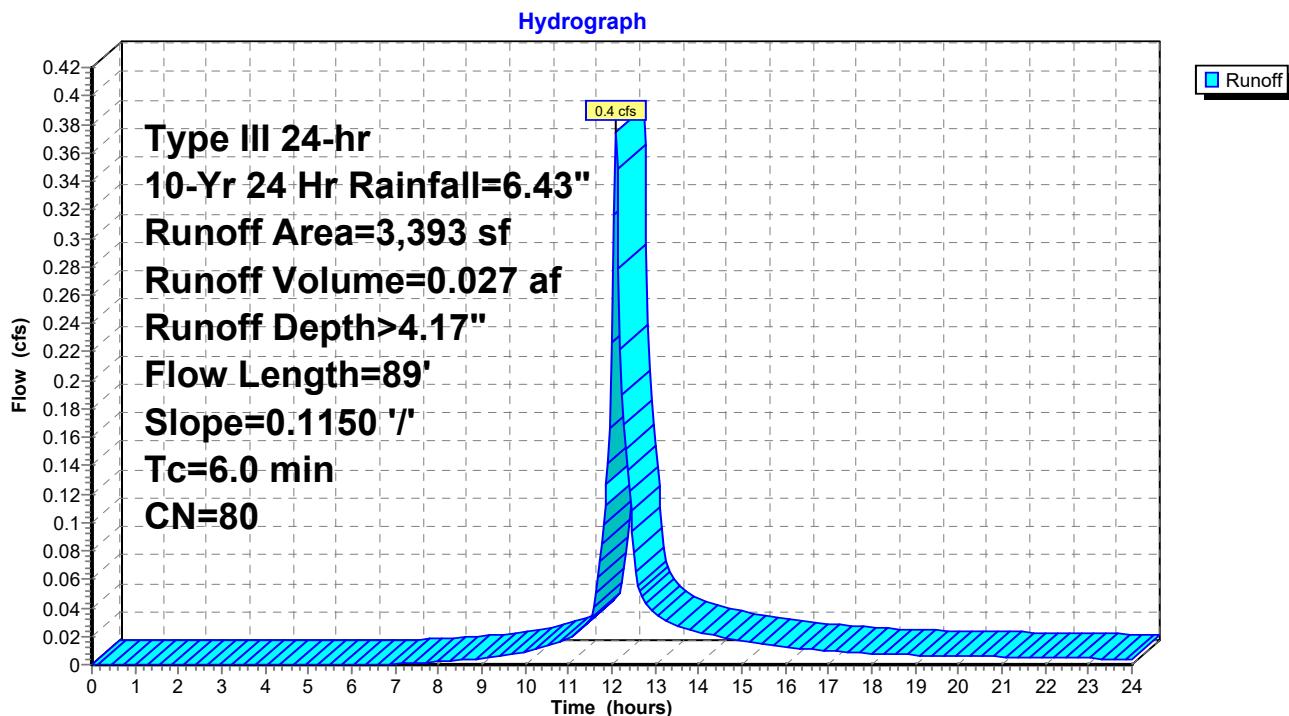
Runoff = 0.4 cfs @ 12.09 hrs, Volume= 0.027 af, Depth> 4.17"  
 Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 10-Yr 24 Hr Rainfall=6.43"

Area (sf)	CN	Description
3,393	80	>75% Grass cover, Good, HSG D
3,393		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1150	0.2		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 4.01"
0.4	39	0.1150	1.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.0					<b>Direct Entry, Min. Engineering Practice</b>
6.0	89	Total			

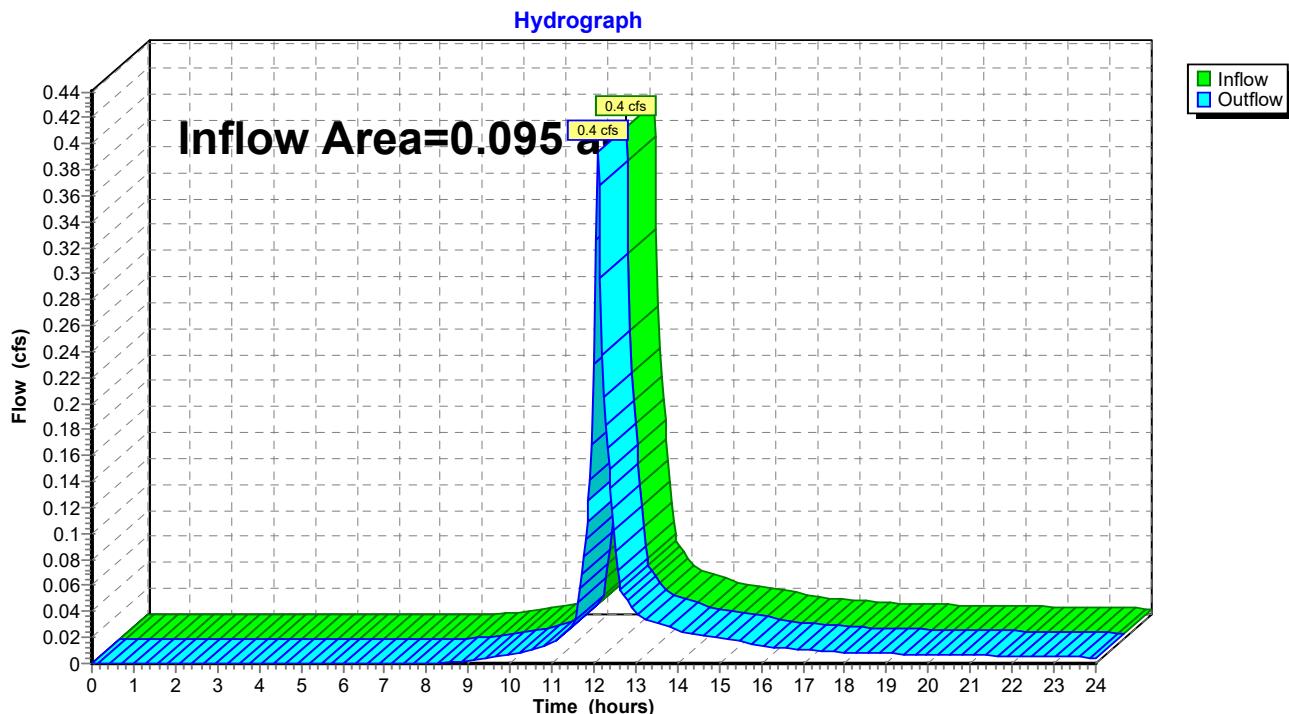
### Subcatchment SC-301: Subcatchment 301



**Summary for Reach DP-1: Design Point 1**

Inflow Area = 0.095 ac, 59.23% Impervious, Inflow Depth > 3.55" for 10-Yr 24 Hr event  
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.028 af  
Outflow = 0.4 cfs @ 12.09 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-1: Design Point 1**

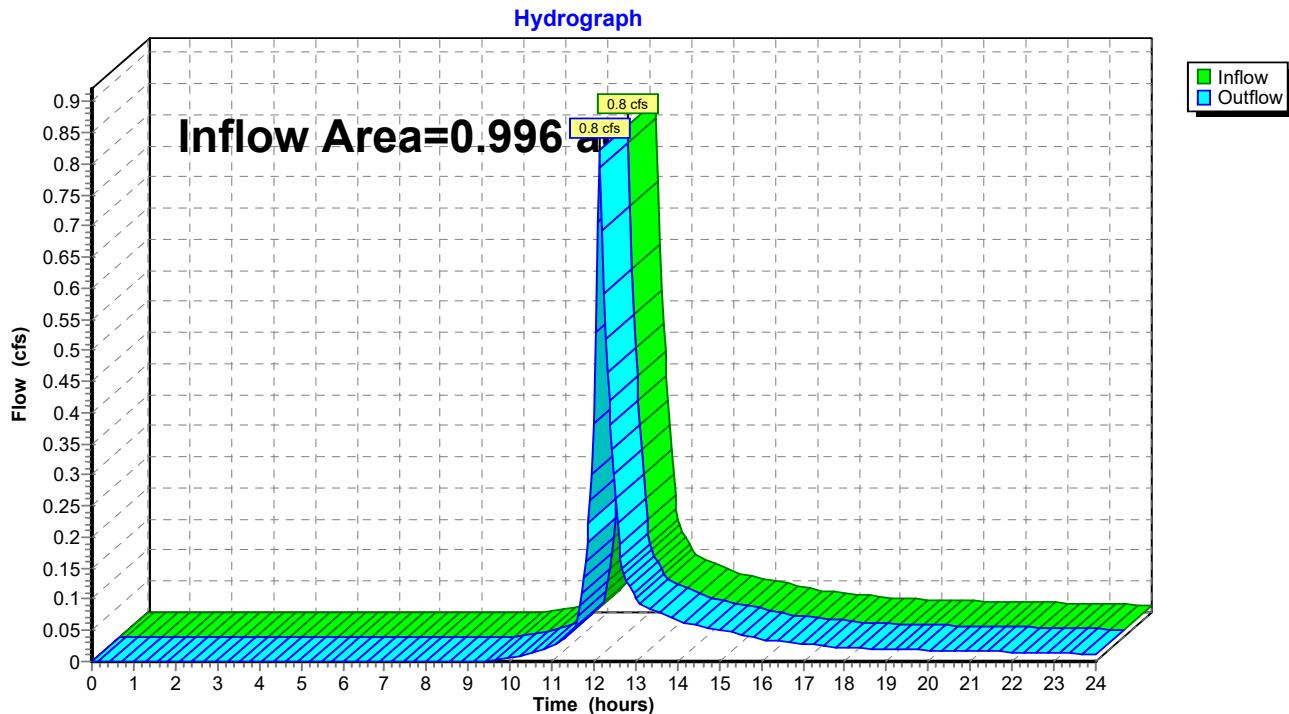
**Summary for Reach DP-2: Design Point 2**

Inflow Area = 0.996 ac, 59.15% Impervious, Inflow Depth &gt; 0.79" for 10-Yr 24 Hr event

Inflow = 0.8 cfs @ 12.13 hrs, Volume= 0.066 af

Outflow = 0.8 cfs @ 12.13 hrs, Volume= 0.066 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-2: Design Point 2**

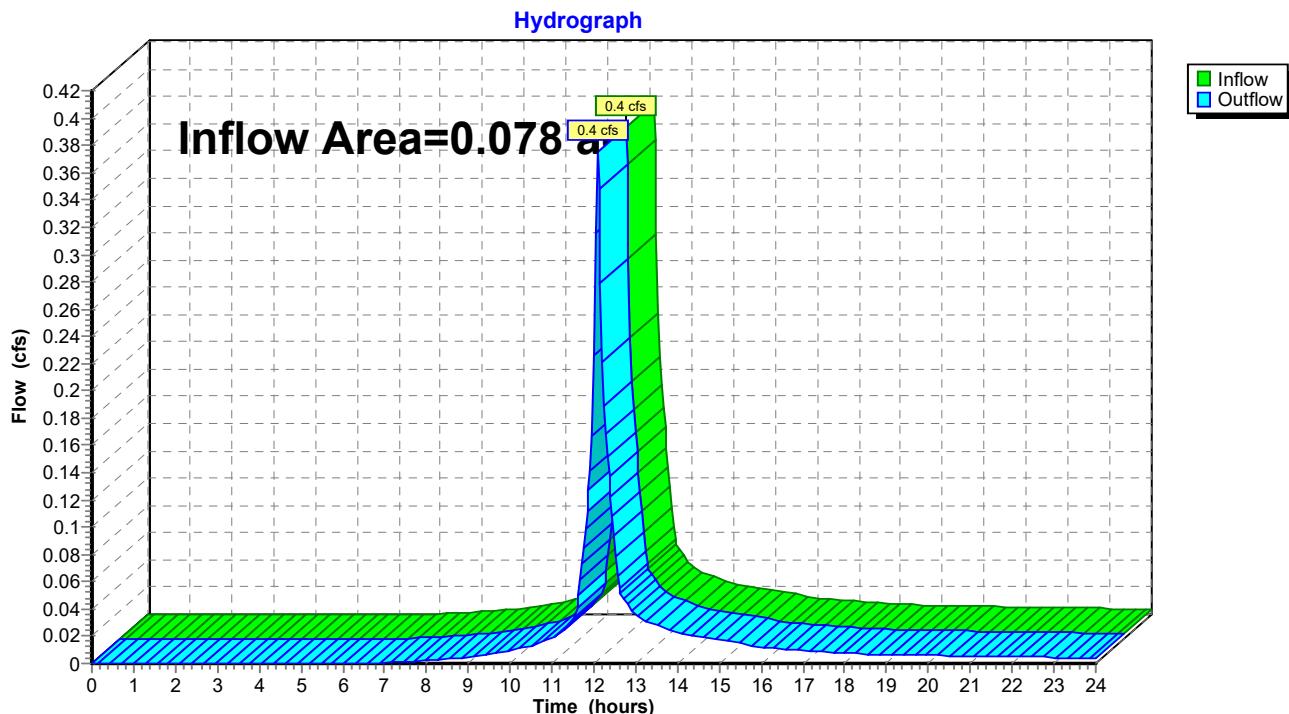
**Summary for Reach DP-3: Design Point 3**

Inflow Area = 0.078 ac, 0.00% Impervious, Inflow Depth &gt; 4.17" for 10-Yr 24 Hr event

Inflow = 0.4 cfs @ 12.09 hrs, Volume= 0.027 af

Outflow = 0.4 cfs @ 12.09 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-3: Design Point 3**

## Summary for Pond PSIS: PSIS

Inflow Area = 0.718 ac, 80.26% Impervious, Inflow Depth > 5.26" for 10-Yr 24 Hr event  
 Inflow = 4.2 cfs @ 12.09 hrs, Volume= 0.315 af  
 Outflow = 0.2 cfs @ 10.24 hrs, Volume= 0.216 af, Atten= 96%, Lag= 0.0 min  
 Discarded = 0.2 cfs @ 10.24 hrs, Volume= 0.216 af  
 Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Peak Elev= 84.97' @ 15.18 hrs Surf.Area= 2,958 sf Storage= 7,235 cf

Plug-Flow detention time= 270.8 min calculated for 0.216 af (69% of inflow)  
 Center-of-Mass det. time= 178.2 min ( 960.2 - 782.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	81.50'	5,019 cf	<b>83.00'W x 35.64'L x 6.75'H Field A</b> 19,968 cf Overall - 7,420 cf Embedded = 12,548 cf x 40.0% Voids
#2A	82.25'	7,420 cf	<b>ADS_StormTech MC-4500 b +Capx 63 Inside #1</b> Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 63 Chambers in 9 Rows Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf
12,439 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	81.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	86.67'	<b>6.0" Vert. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#3	Primary	86.67'	<b>12.0" Round Culvert</b> L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.67' / 86.50' S= 0.0340 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.2 cfs @ 10.24 hrs HW=81.57' (Free Discharge)  
 ↑ 1=Exfiltration (Exfiltration Controls 0.2 cfs)

**Primary OutFlow** Max=0.0 cfs @ 0.00 hrs HW=81.50' (Free Discharge)  
 ↑ 3=Culvert ( Controls 0.0 cfs)  
 ↑ 2=Orifice/Grate ( Controls 0.0 cfs)

**Pond PSIS: PSIS - Chamber Wizard Field A****Chamber Model = ADS\_StormTechMC-4500 b +Cap (ADS StormTech®MC-4500 with cap volume)**

Effective Size= 90.4"W x 60.0"H =&gt; 26.46 sf x 4.03'L = 106.5 cf

Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap

Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

7 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 33.64' Row Length +12.0" End Stone x 2 = 35.64'  
Base Length

9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width

9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

63 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 9 Rows = 7,419.9 cf Chamber Storage

19,968.2 cf Field - 7,419.9 cf Chambers = 12,548.3 cf Stone x 40.0% Voids = 5,019.3 cf Stone Storage

Chamber Storage + Stone Storage = 12,439.2 cf = 0.286 af

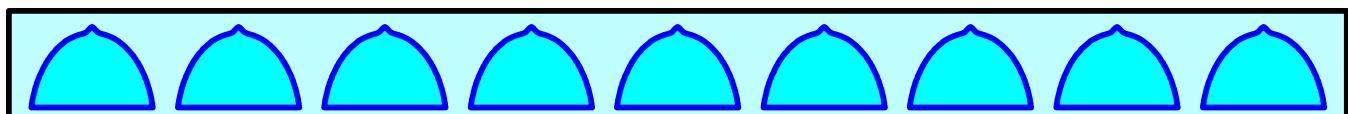
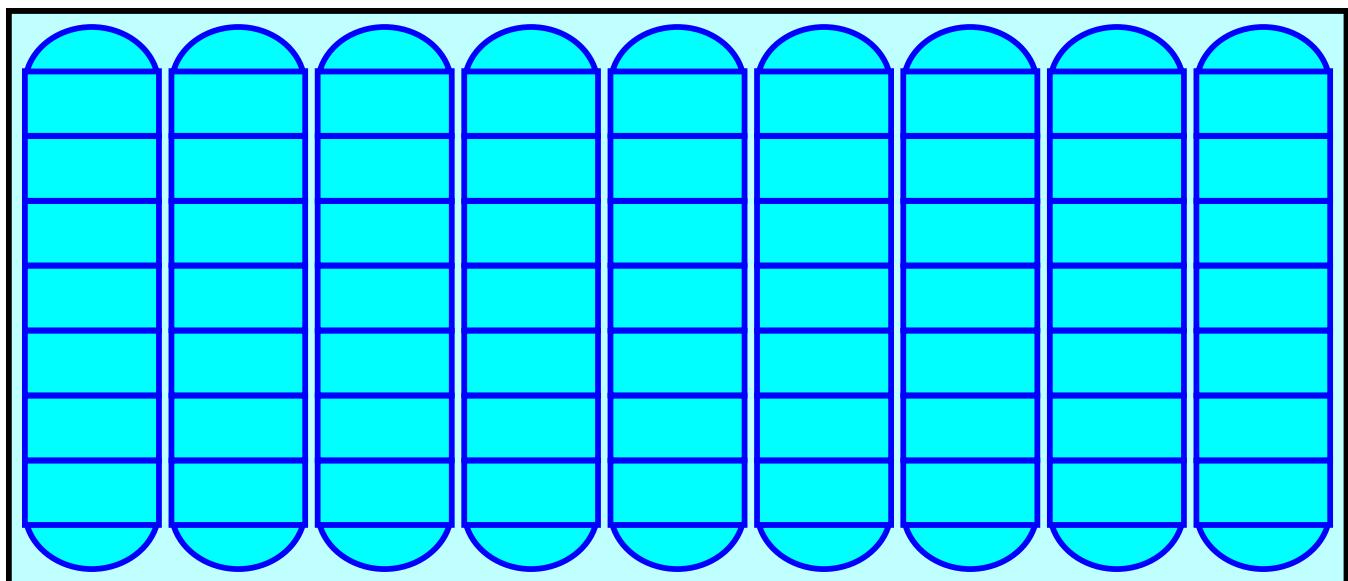
Overall Storage Efficiency = 62.3%

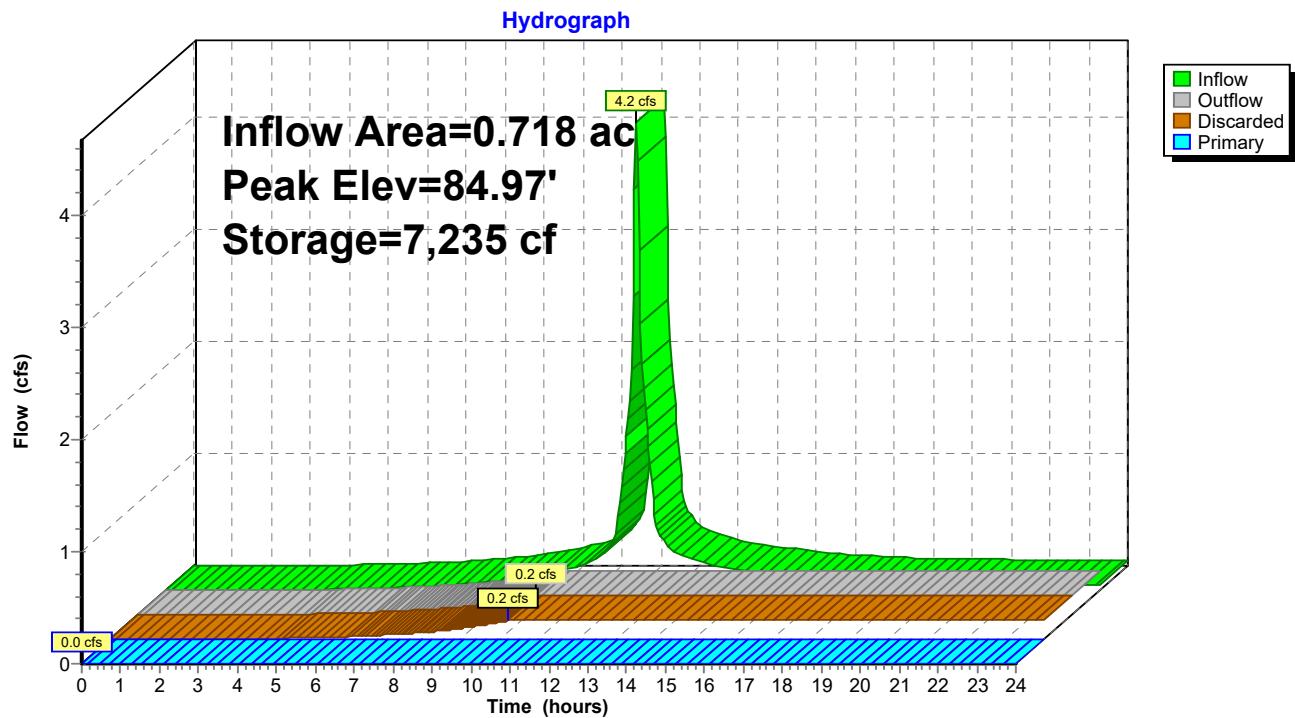
Overall System Size = 35.64' x 83.00' x 6.75'

63 Chambers

739.6 cy Field

464.8 cy Stone



**Pond PSIS: PSIS**

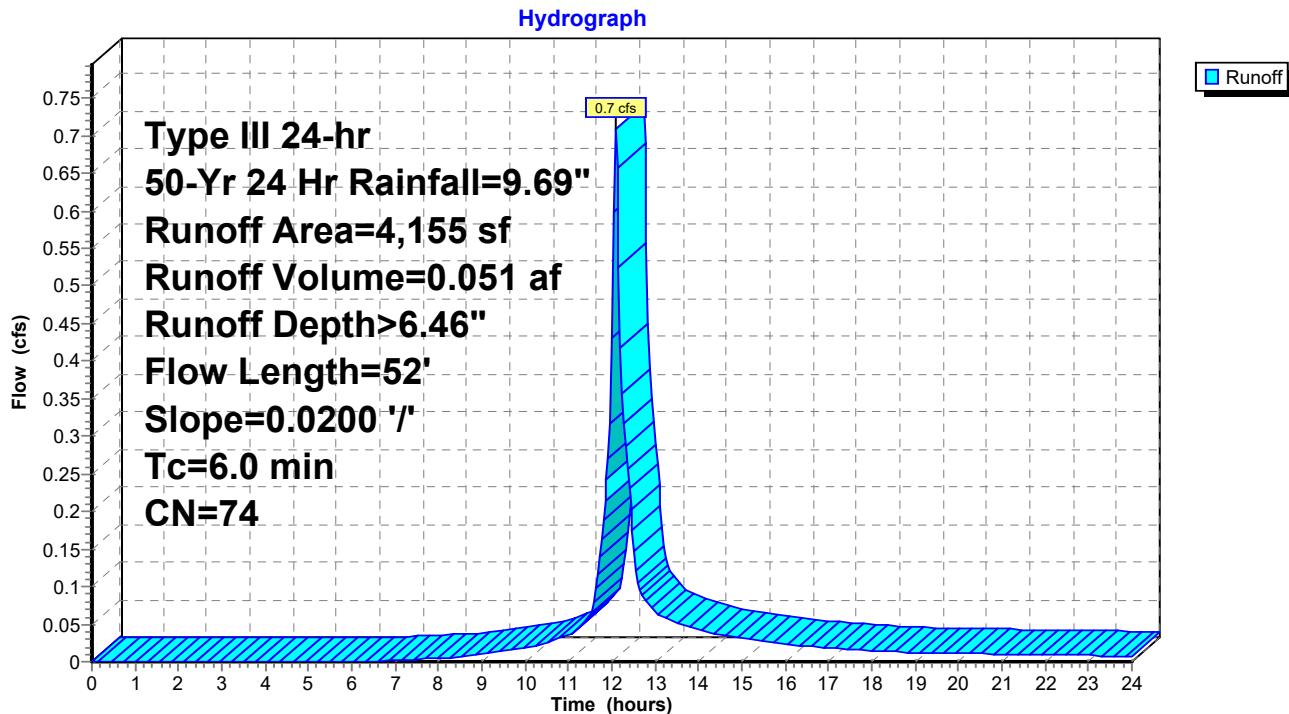
### Summary for Subcatchment SC-101: Subcatchment 101

Runoff = 0.7 cfs @ 12.09 hrs, Volume= 0.051 af, Depth> 6.46"  
 Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
1,288	39	>75% Grass cover, Good, HSG A
*	2,243	Proposed Driveway
*	218	Existing Roof
406	39	>75% Grass cover, Good, HSG A
4,155	74	Weighted Average
1,694		40.77% Pervious Area
2,461		59.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	25	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
0.4	25	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.01"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.7					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-101: Subcatchment 101**

### Summary for Subcatchment SC-201: Subcatchment 201

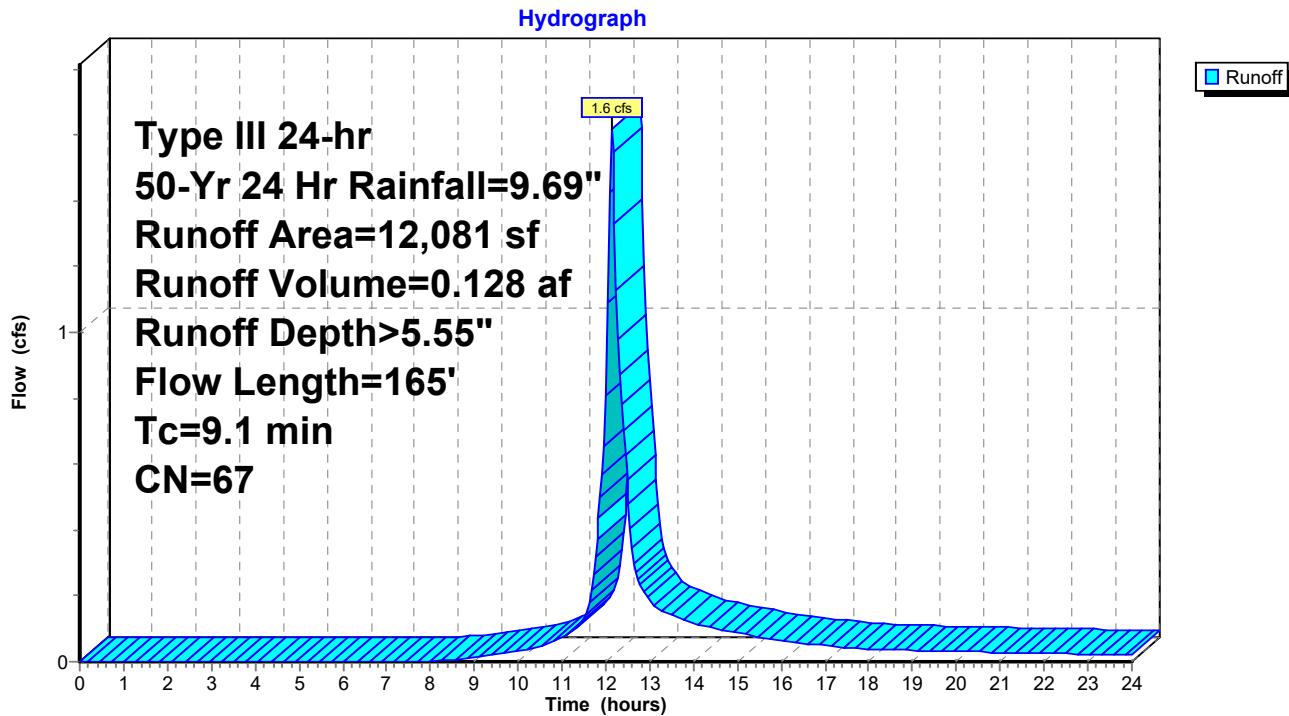
Runoff = 1.6 cfs @ 12.13 hrs, Volume= 0.128 af, Depth> 5.55"  
 Routed to Reach DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
4,295	39	>75% Grass cover, Good, HSG A
*	791	Proposed Stone Dust Walkway
6,455	80	>75% Grass cover, Good, HSG D
*	218	Existing Roof
*	322	Existing Roof

12,081	67	Weighted Average
11,541		95.53% Pervious Area
540		4.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0570	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
4.8	89	0.0700	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
1.0	26	0.3300	0.4		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
9.1	165	Total			

**Subcatchment SC-201: Subcatchment 201**

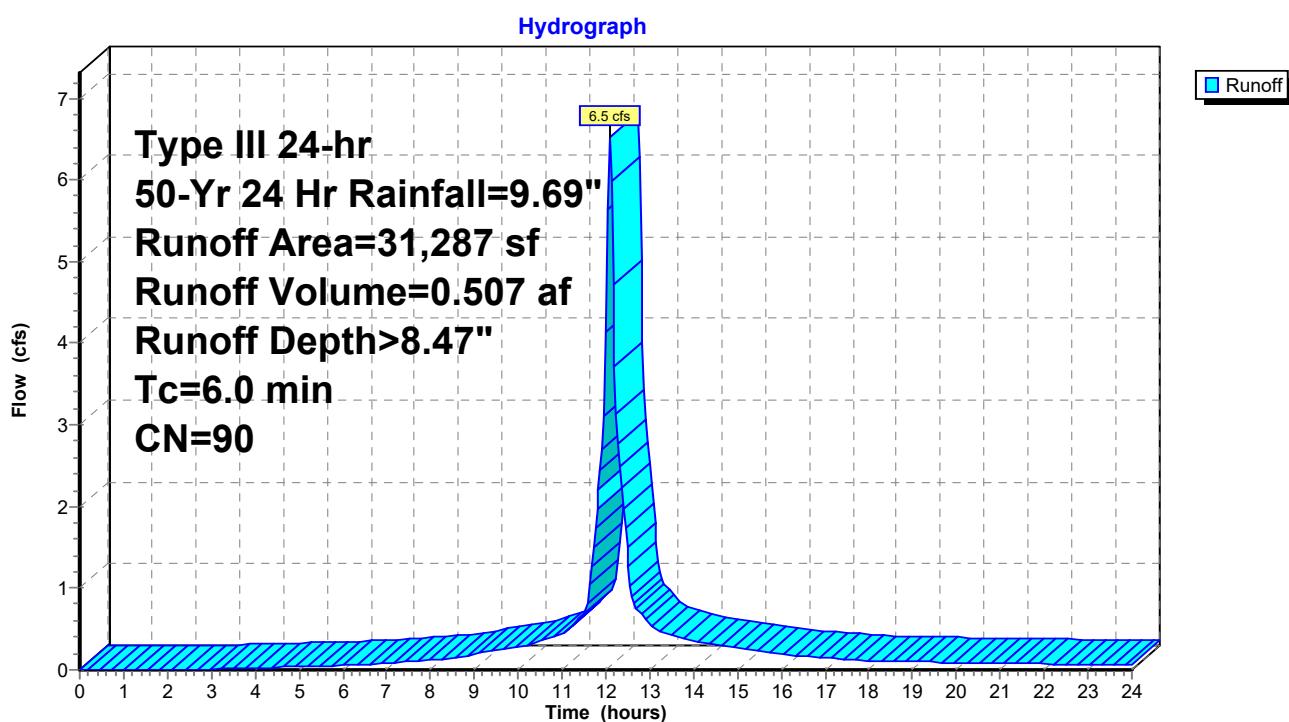
### Summary for Subcatchment SC-202: Subcatchment 202

Runoff = 6.5 cfs @ 12.08 hrs, Volume= 0.507 af, Depth> 8.47"  
 Routed to Pond PSIS : PSIS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description			
* 24,400	98	Proposed Roof Area			
3,872	39	>75% Grass cover, Good, HSG A			
1,583	80	>75% Grass cover, Good, HSG D			
* 720	96	Proposed Stone Dust Walkway			
* 712	98	Proposed Bit. Conc. Walkway			
31,287	90	Weighted Average			
6,175		19.74% Pervious Area			
25,112		80.26% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Engineering Standard

### Subcatchment SC-202: Subcatchment 202



### Summary for Subcatchment SC-301: Subcatchment 301

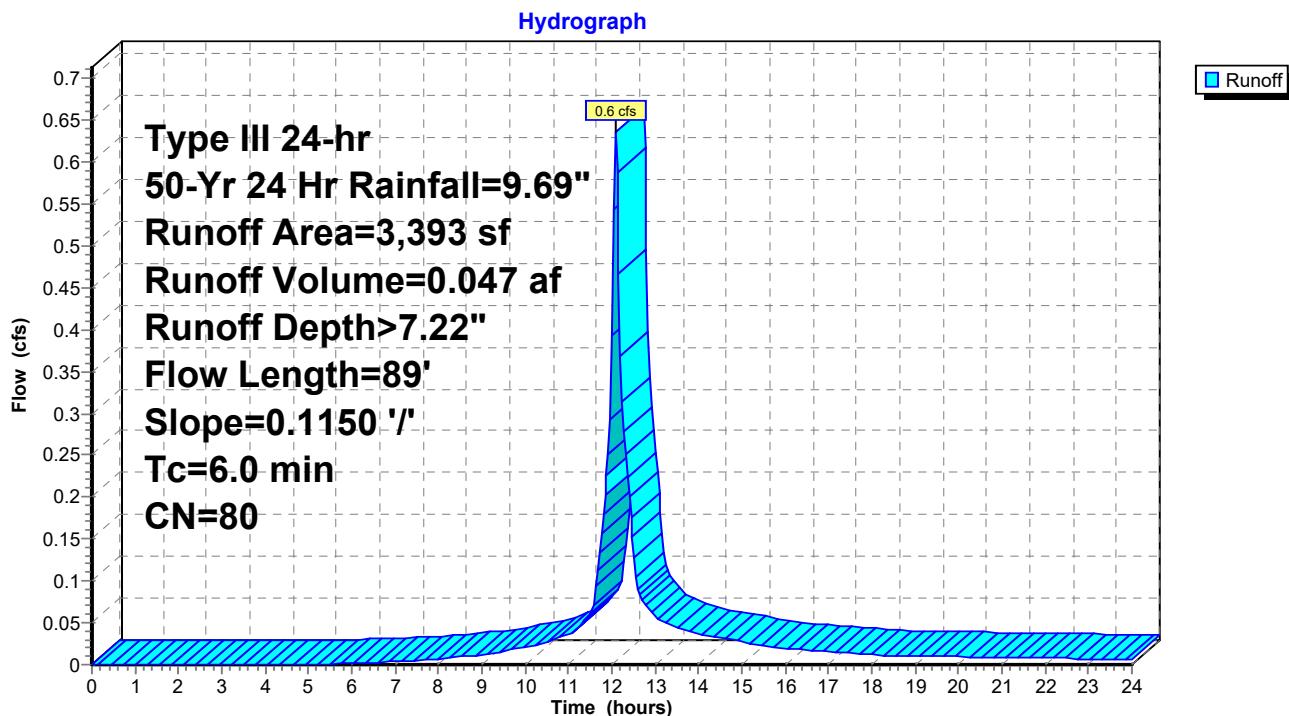
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 0.047 af, Depth> 7.22"  
 Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 50-Yr 24 Hr Rainfall=9.69"

Area (sf)	CN	Description
3,393	80	>75% Grass cover, Good, HSG D
3,393		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1150	0.2		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 4.01"
0.4	39	0.1150	1.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.0					<b>Direct Entry, Min. Engineering Practice</b>
6.0	89	Total			

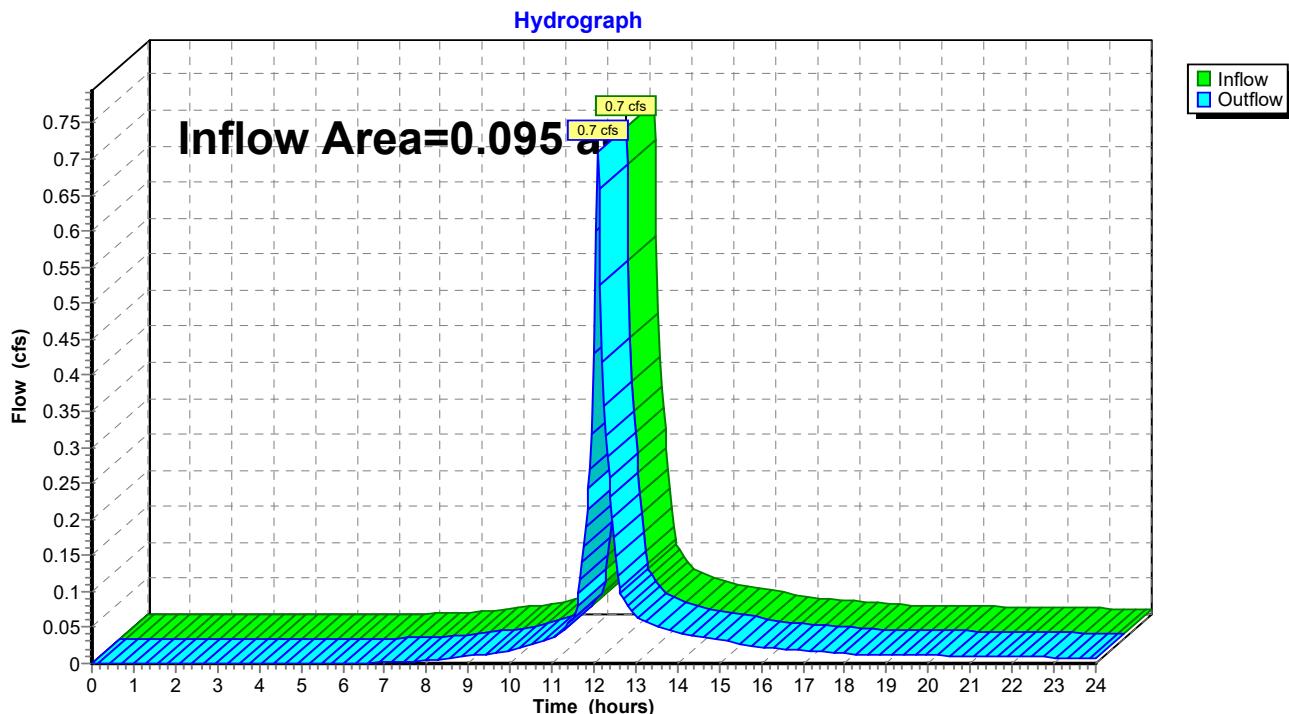
### Subcatchment SC-301: Subcatchment 301



**Summary for Reach DP-1: Design Point 1**

Inflow Area = 0.095 ac, 59.23% Impervious, Inflow Depth > 6.46" for 50-Yr 24 Hr event  
Inflow = 0.7 cfs @ 12.09 hrs, Volume= 0.051 af  
Outflow = 0.7 cfs @ 12.09 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-1: Design Point 1**

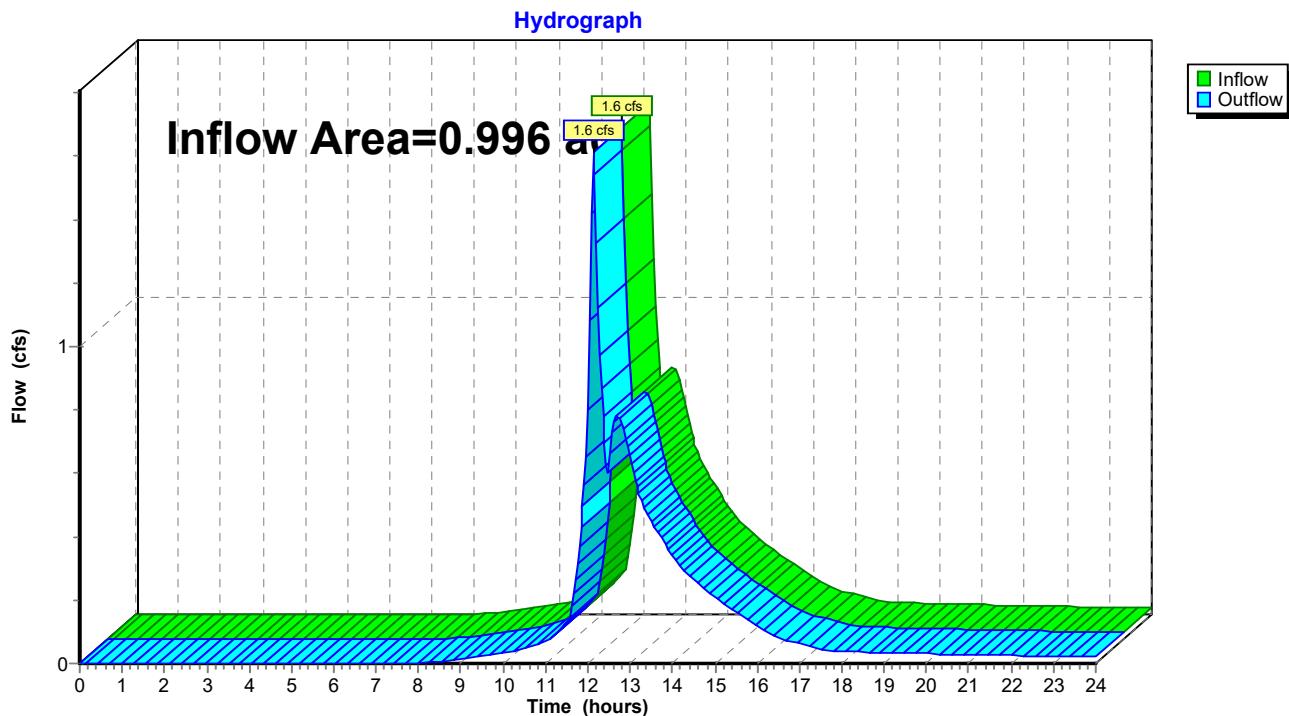
**Summary for Reach DP-2: Design Point 2**

Inflow Area = 0.996 ac, 59.15% Impervious, Inflow Depth &gt; 2.38" for 50-Yr 24 Hr event

Inflow = 1.6 cfs @ 12.13 hrs, Volume= 0.198 af

Outflow = 1.6 cfs @ 12.13 hrs, Volume= 0.198 af, Atten= 0%, Lag= 0.0 min

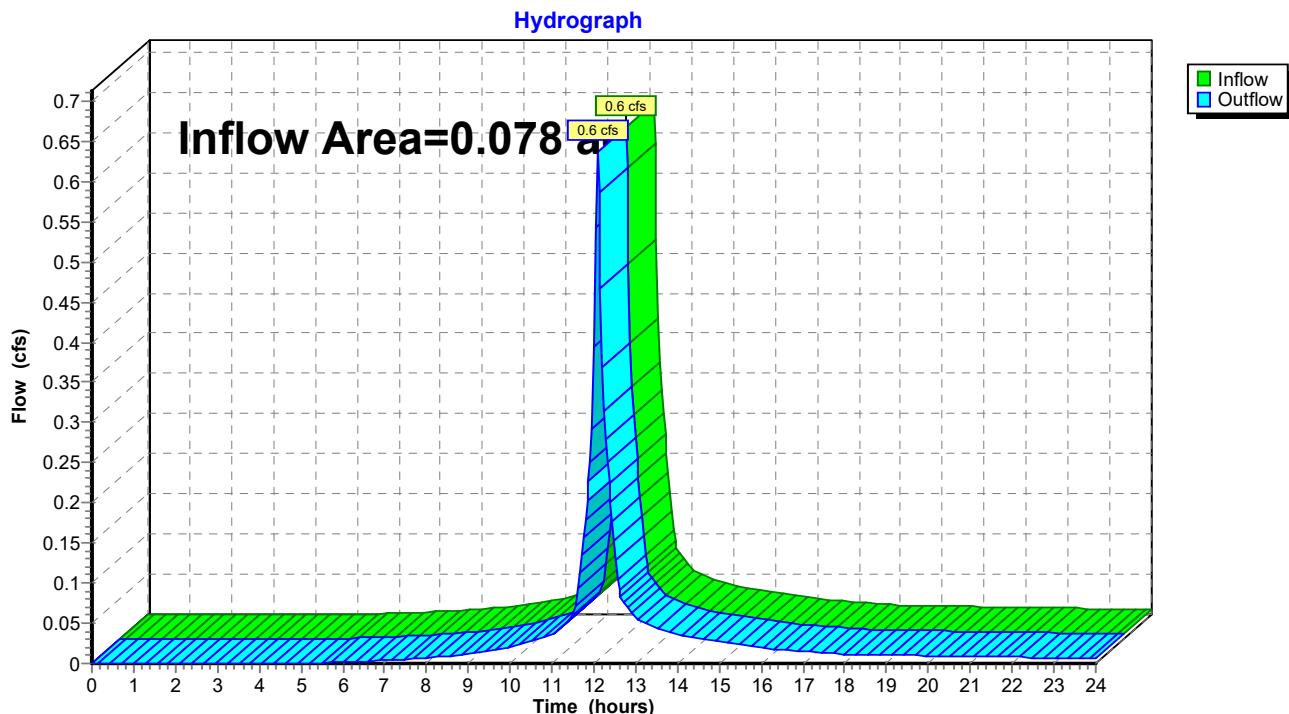
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-2: Design Point 2**

**Summary for Reach DP-3: Design Point 3**

Inflow Area = 0.078 ac, 0.00% Impervious, Inflow Depth > 7.22" for 50-Yr 24 Hr event  
Inflow = 0.6 cfs @ 12.09 hrs, Volume= 0.047 af  
Outflow = 0.6 cfs @ 12.09 hrs, Volume= 0.047 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-3: Design Point 3**

### Summary for Pond PSIS: PSIS

Inflow Area = 0.718 ac, 80.26% Impervious, Inflow Depth > 8.47" for 50-Yr 24 Hr event  
 Inflow = 6.5 cfs @ 12.08 hrs, Volume= 0.507 af  
 Outflow = 0.7 cfs @ 12.77 hrs, Volume= 0.308 af, Atten= 89%, Lag= 41.4 min  
 Discarded = 0.2 cfs @ 8.76 hrs, Volume= 0.238 af  
 Primary = 0.5 cfs @ 12.77 hrs, Volume= 0.070 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Peak Elev= 87.09' @ 12.77 hrs Surf.Area= 2,958 sf Storage= 11,058 cf

Plug-Flow detention time= 226.5 min calculated for 0.308 af (61% of inflow)  
 Center-of-Mass det. time= 122.8 min ( 892.9 - 770.0 )

Volume	Invert	Avail.Storage	Storage Description
#1A	81.50'	5,019 cf	<b>83.00'W x 35.64'L x 6.75'H Field A</b> 19,968 cf Overall - 7,420 cf Embedded = 12,548 cf x 40.0% Voids
#2A	82.25'	7,420 cf	<b>ADS_StormTech MC-4500 b +Capx 63 Inside #1</b> Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 63 Chambers in 9 Rows Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf
12,439 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	81.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	86.67'	<b>6.0" Vert. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#3	Primary	86.67'	<b>12.0" Round Culvert</b> L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.67' / 86.50' S= 0.0340 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.2 cfs @ 8.76 hrs HW=81.57' (Free Discharge)  
 ↑ 1=Exfiltration (Exfiltration Controls 0.2 cfs)

**Primary OutFlow** Max=0.5 cfs @ 12.77 hrs HW=87.09' (Free Discharge)  
 ↑ 3=Culvert (Inlet Controls 0.5 cfs @ 1.7 fps)  
 ↑ 2=Orifice/Grate (Passes 0.5 cfs of 0.8 cfs potential flow)

**Pond PSIS: PSIS - Chamber Wizard Field A****Chamber Model = ADS\_StormTechMC-4500 b +Cap (ADS StormTech®MC-4500 with cap volume)**

Effective Size= 90.4"W x 60.0"H =&gt; 26.46 sf x 4.03'L = 106.5 cf

Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap

Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

7 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 33.64' Row Length +12.0" End Stone x 2 = 35.64'  
Base Length

9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width

9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

63 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 9 Rows = 7,419.9 cf Chamber Storage

19,968.2 cf Field - 7,419.9 cf Chambers = 12,548.3 cf Stone x 40.0% Voids = 5,019.3 cf Stone Storage

Chamber Storage + Stone Storage = 12,439.2 cf = 0.286 af

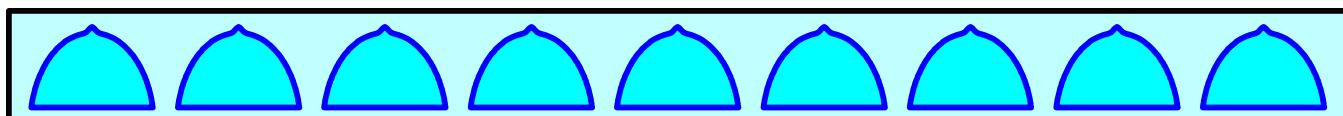
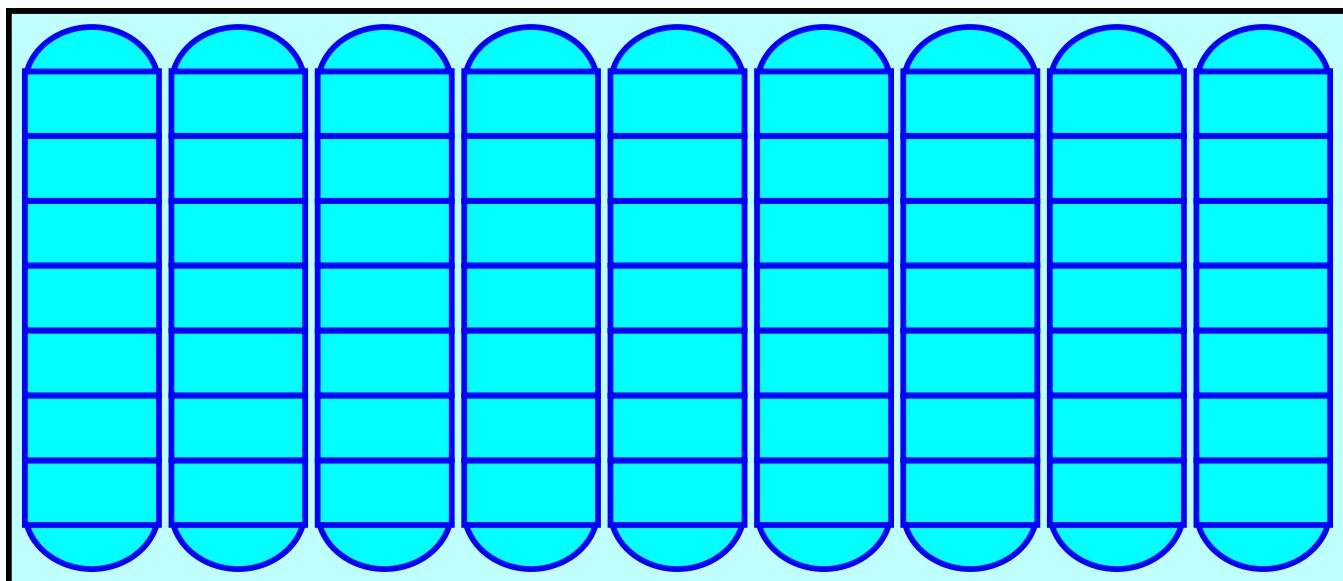
Overall Storage Efficiency = 62.3%

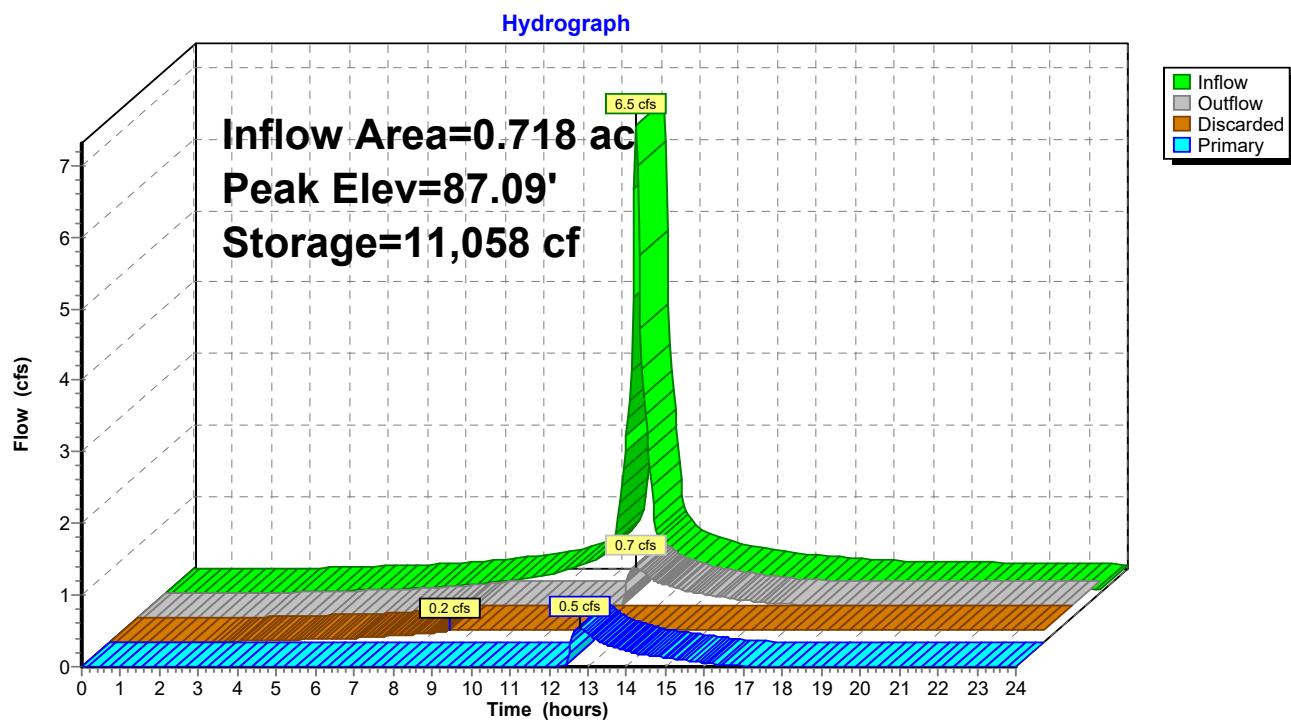
Overall System Size = 35.64' x 83.00' x 6.75'

63 Chambers

739.6 cy Field

464.8 cy Stone



**Pond PSIS: PSIS**

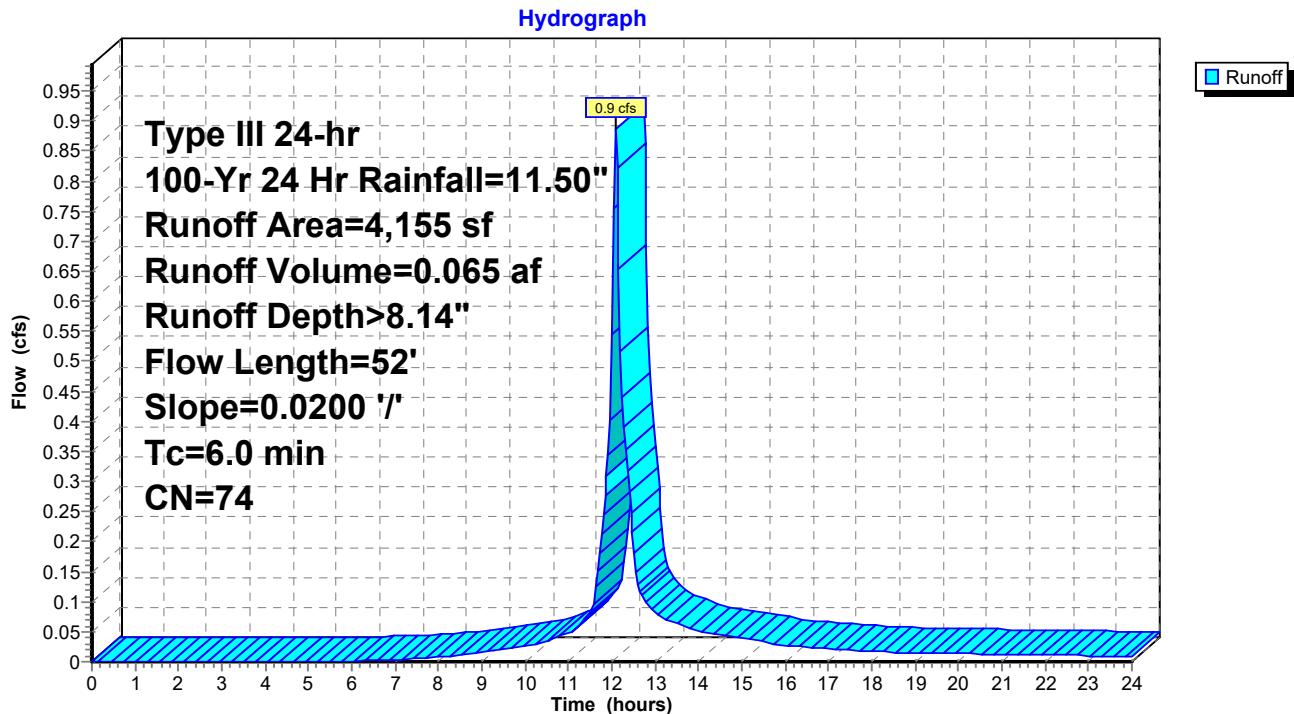
### Summary for Subcatchment SC-101: Subcatchment 101

Runoff = 0.9 cfs @ 12.09 hrs, Volume= 0.065 af, Depth> 8.14"  
 Routed to Reach DP-1 : Design Point 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
1,288	39	>75% Grass cover, Good, HSG A
*	2,243	Proposed Driveway
*	218	Existing Roof
	406	>75% Grass cover, Good, HSG A
4,155	74	Weighted Average
1,694		40.77% Pervious Area
2,461		59.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	25	0.0200	0.1		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
0.4	25	0.0200	1.2		<b>Sheet Flow,</b> Smooth surfaces n= 0.011 P2= 4.01"
0.0	2	0.0200	2.9		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.7					<b>Direct Entry, Min. Engineering Practice</b>
6.0	52	Total			

**Subcatchment SC-101: Subcatchment 101**

### Summary for Subcatchment SC-201: Subcatchment 201

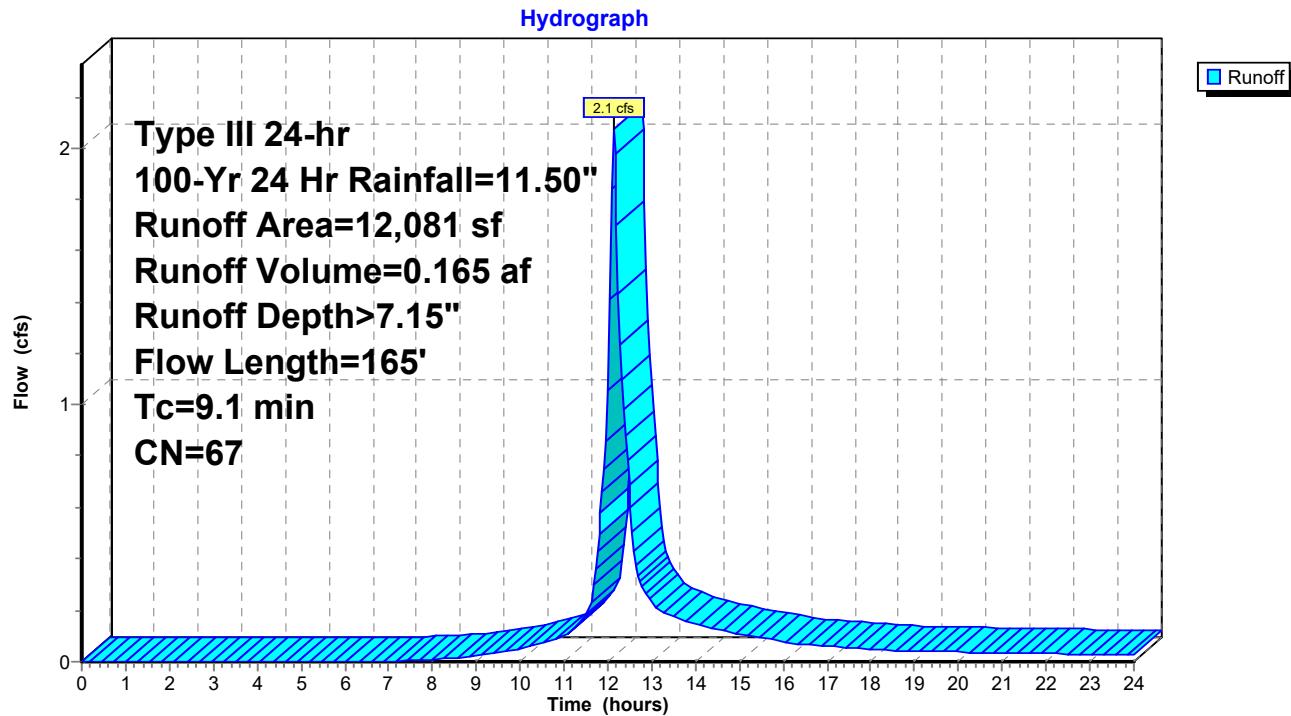
Runoff = 2.1 cfs @ 12.13 hrs, Volume= 0.165 af, Depth> 7.15"  
 Routed to Reach DP-2 : Design Point 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
4,295	39	>75% Grass cover, Good, HSG A
*	791	Proposed Stone Dust Walkway
6,455	80	>75% Grass cover, Good, HSG D
*	218	Existing Roof
*	322	Existing Roof

12,081	67	Weighted Average
11,541		95.53% Pervious Area
540		4.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	50	0.0570	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
4.8	89	0.0700	0.3		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
1.0	26	0.3300	0.4		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 4.01"
9.1	165	Total			

**Subcatchment SC-201: Subcatchment 201**

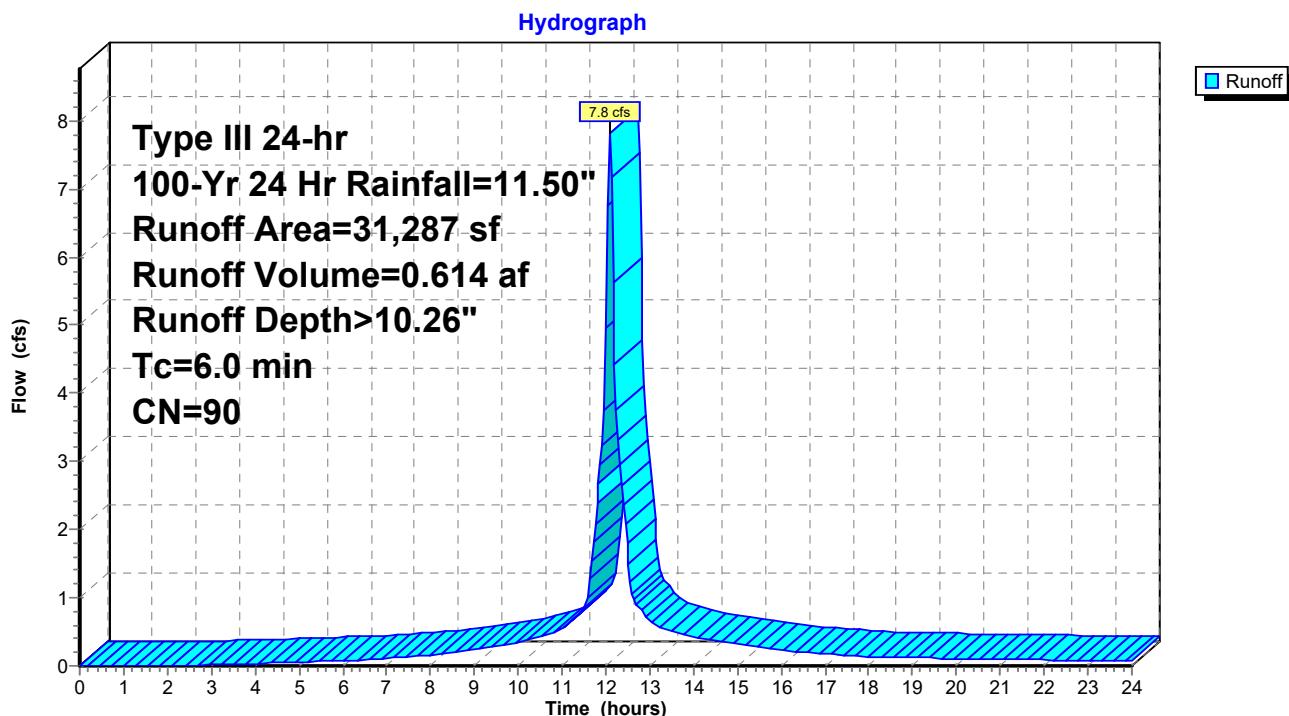
### Summary for Subcatchment SC-202: Subcatchment 202

Runoff = 7.8 cfs @ 12.08 hrs, Volume= 0.614 af, Depth>10.26"  
 Routed to Pond PSIS : PSIS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description			
* 24,400	98	Proposed Roof Area			
3,872	39	>75% Grass cover, Good, HSG A			
1,583	80	>75% Grass cover, Good, HSG D			
* 720	96	Proposed Stone Dust Walkway			
* 712	98	Proposed Bit. Conc. Walkway			
31,287	90	Weighted Average			
6,175		19.74% Pervious Area			
25,112		80.26% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Min. Engineering Standard

### Subcatchment SC-202: Subcatchment 202



### Summary for Subcatchment SC-301: Subcatchment 301

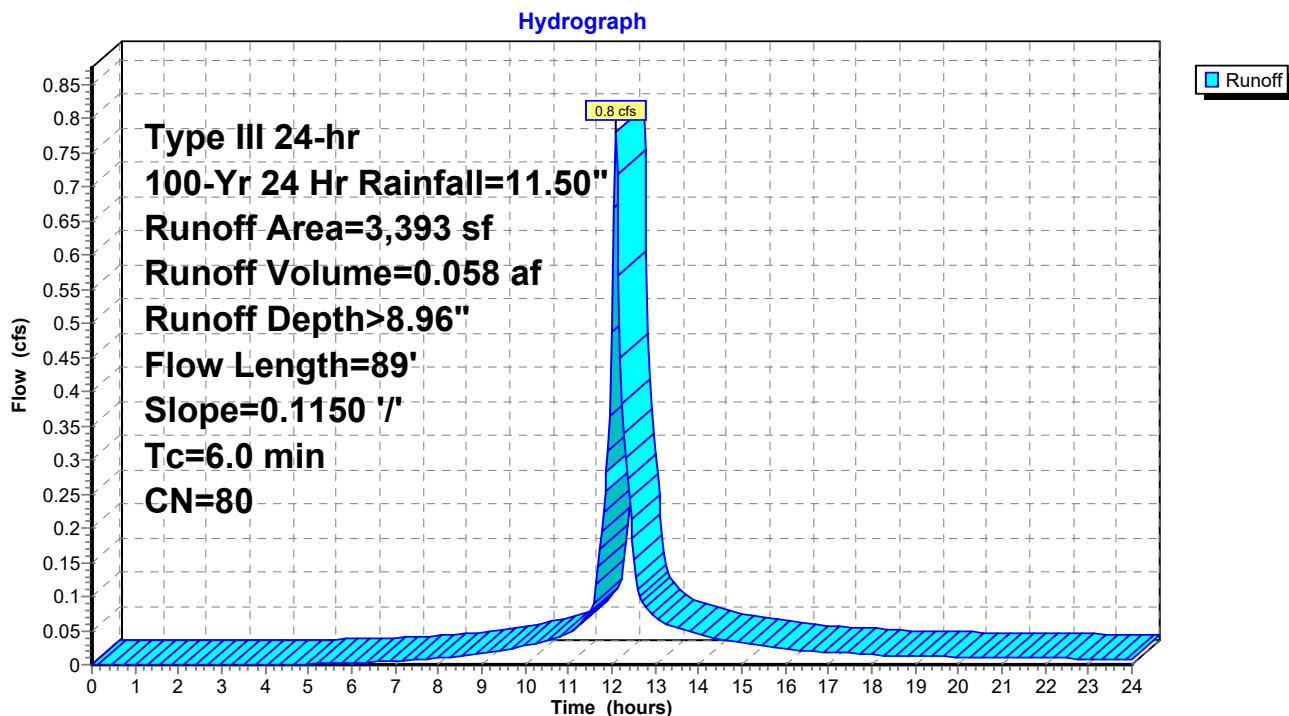
Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.058 af, Depth> 8.96"  
 Routed to Reach DP-3 : Design Point 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Type III 24-hr 100-Yr 24 Hr Rainfall=11.50"

Area (sf)	CN	Description
3,393	80	>75% Grass cover, Good, HSG D
3,393		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.1150	0.2		<b>Sheet Flow,</b> Grass: Dense n= 0.240 P2= 4.01"
0.4	39	0.1150	1.7		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
2.0					<b>Direct Entry, Min. Engineering Practice</b>
6.0	89	Total			

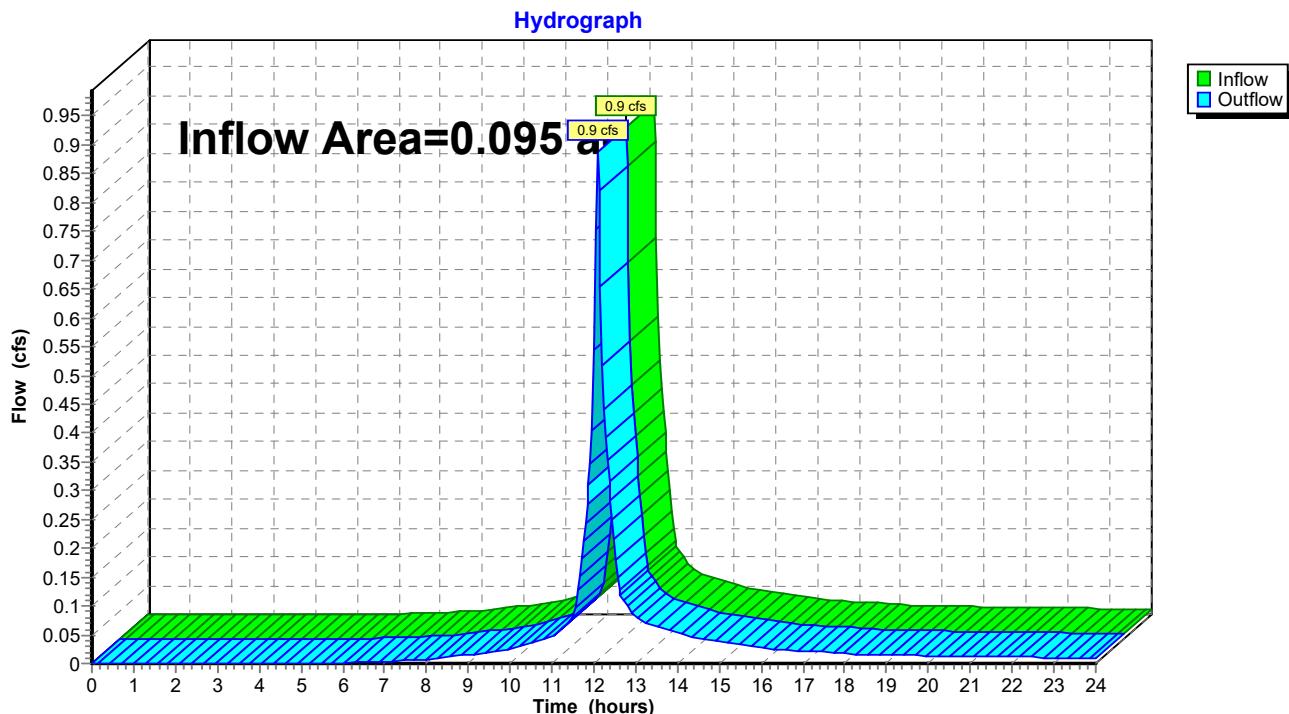
### Subcatchment SC-301: Subcatchment 301



**Summary for Reach DP-1: Design Point 1**

Inflow Area = 0.095 ac, 59.23% Impervious, Inflow Depth > 8.14" for 100-Yr 24 Hr event  
Inflow = 0.9 cfs @ 12.09 hrs, Volume= 0.065 af  
Outflow = 0.9 cfs @ 12.09 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

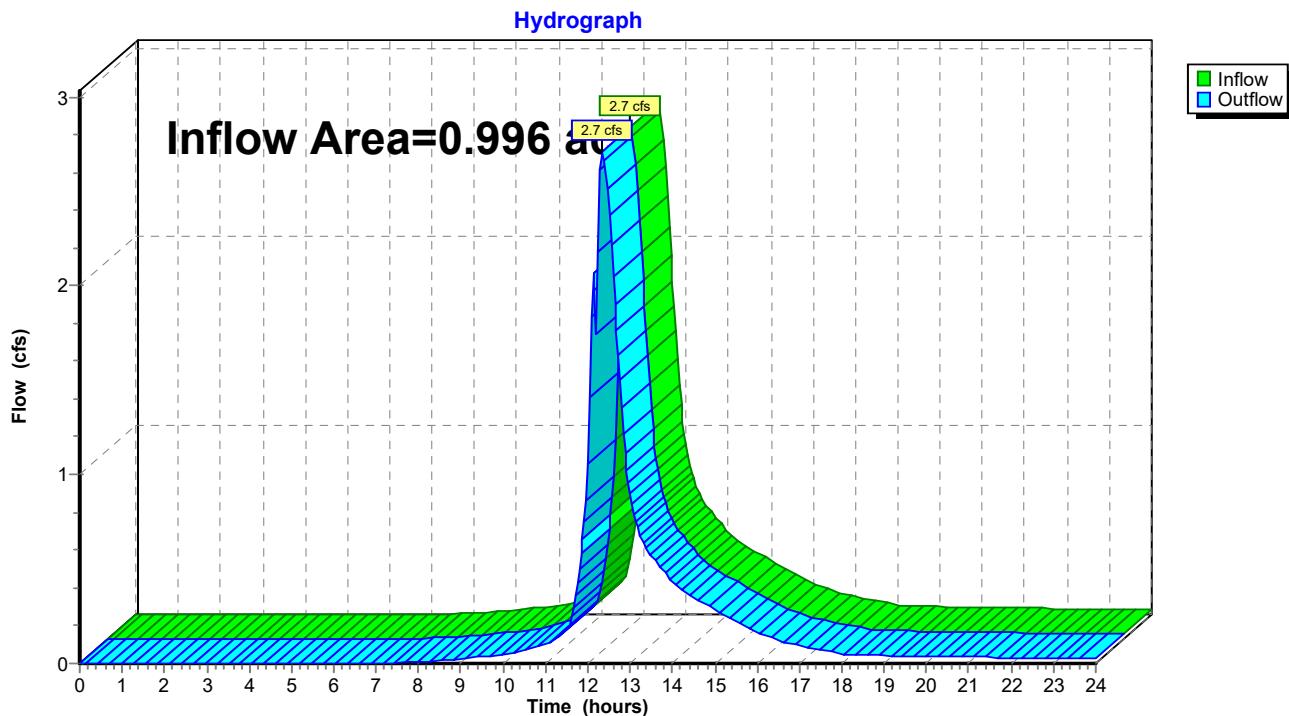
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-1: Design Point 1**

**Summary for Reach DP-2: Design Point 2**

Inflow Area = 0.996 ac, 59.15% Impervious, Inflow Depth > 3.88" for 100-Yr 24 Hr event  
Inflow = 2.7 cfs @ 12.35 hrs, Volume= 0.322 af  
Outflow = 2.7 cfs @ 12.35 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.0 min

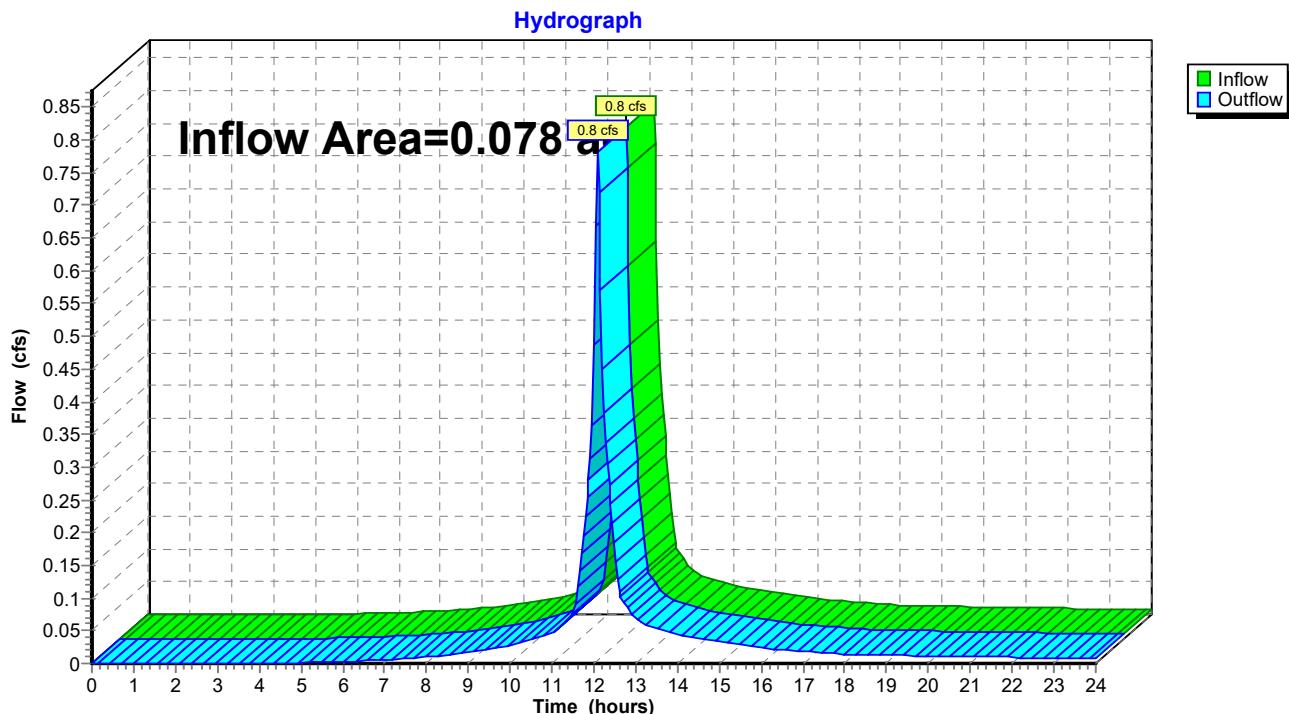
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-2: Design Point 2**

**Summary for Reach DP-3: Design Point 3**

Inflow Area = 0.078 ac, 0.00% Impervious, Inflow Depth > 8.96" for 100-Yr 24 Hr event  
Inflow = 0.8 cfs @ 12.09 hrs, Volume= 0.058 af  
Outflow = 0.8 cfs @ 12.09 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs

**Reach DP-3: Design Point 3**

### Summary for Pond PSIS: PSIS

Inflow Area = 0.718 ac, 80.26% Impervious, Inflow Depth > 10.26" for 100-Yr 24 Hr event  
 Inflow = 7.8 cfs @ 12.08 hrs, Volume= 0.614 af  
 Outflow = 2.0 cfs @ 12.45 hrs, Volume= 0.405 af, Atten= 75%, Lag= 22.1 min  
 Discarded = 0.2 cfs @ 8.28 hrs, Volume= 0.248 af  
 Primary = 1.8 cfs @ 12.45 hrs, Volume= 0.157 af  
 Routed to Reach DP-2 : Design Point 2

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.04 hrs  
 Peak Elev= 87.85' @ 12.45 hrs Surf.Area= 2,958 sf Storage= 11,971 cf

Plug-Flow detention time= 188.3 min calculated for 0.405 af (66% of inflow)  
 Center-of-Mass det. time= 90.6 min ( 856.1 - 765.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	81.50'	5,019 cf	<b>83.00'W x 35.64'L x 6.75'H Field A</b> 19,968 cf Overall - 7,420 cf Embedded = 12,548 cf x 40.0% Voids
#2A	82.25'	7,420 cf	<b>ADS_StormTech MC-4500 b +Capx 63 Inside #1</b> Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 63 Chambers in 9 Rows Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf
12,439 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	81.50'	<b>2.410 in/hr Exfiltration over Surface area</b>
#2	Device 3	86.67'	<b>6.0" Vert. Orifice/Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#3	Primary	86.67'	<b>12.0" Round Culvert</b> L= 5.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 86.67' / 86.50' S= 0.0340 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.2 cfs @ 8.28 hrs HW=81.57' (Free Discharge)  
 ↑ 1=Exfiltration (Exfiltration Controls 0.2 cfs)

**Primary OutFlow** Max=1.8 cfs @ 12.45 hrs HW=87.85' (Free Discharge)  
 ↑ 3=Culvert (Passes 1.8 cfs of 2.5 cfs potential flow)  
 ↑ 2=Orifice/Grate (Orifice Controls 1.8 cfs @ 4.6 fps)

**Pond PSIS: PSIS - Chamber Wizard Field A****Chamber Model = ADS\_StormTechMC-4500 b +Cap (ADS StormTech®MC-4500 with cap volume)**

Effective Size= 90.4"W x 60.0"H =&gt; 26.46 sf x 4.03'L = 106.5 cf

Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap

Cap Storage= 39.5 cf x 2 x 9 rows = 711.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

7 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 33.64' Row Length +12.0" End Stone x 2 = 35.64'  
Base Length

9 Rows x 100.0" Wide + 9.0" Spacing x 8 + 12.0" Side Stone x 2 = 83.00' Base Width

9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

63 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 9 Rows = 7,419.9 cf Chamber Storage

19,968.2 cf Field - 7,419.9 cf Chambers = 12,548.3 cf Stone x 40.0% Voids = 5,019.3 cf Stone Storage

Chamber Storage + Stone Storage = 12,439.2 cf = 0.286 af

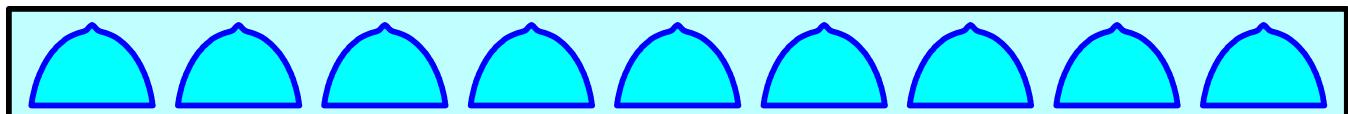
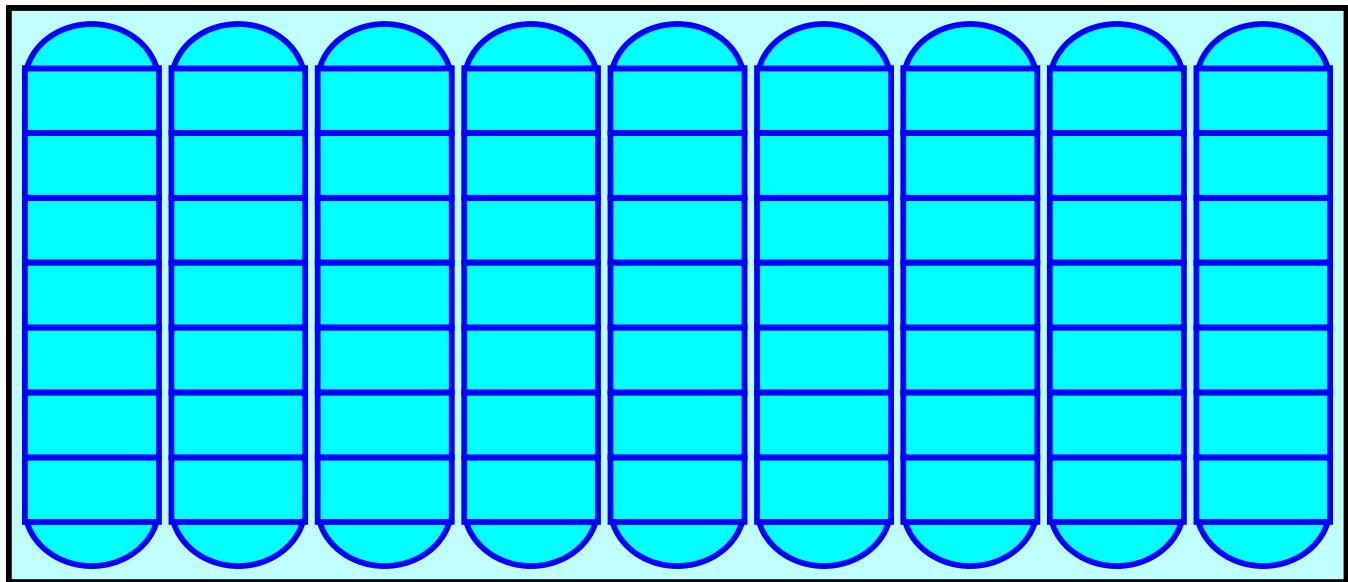
Overall Storage Efficiency = 62.3%

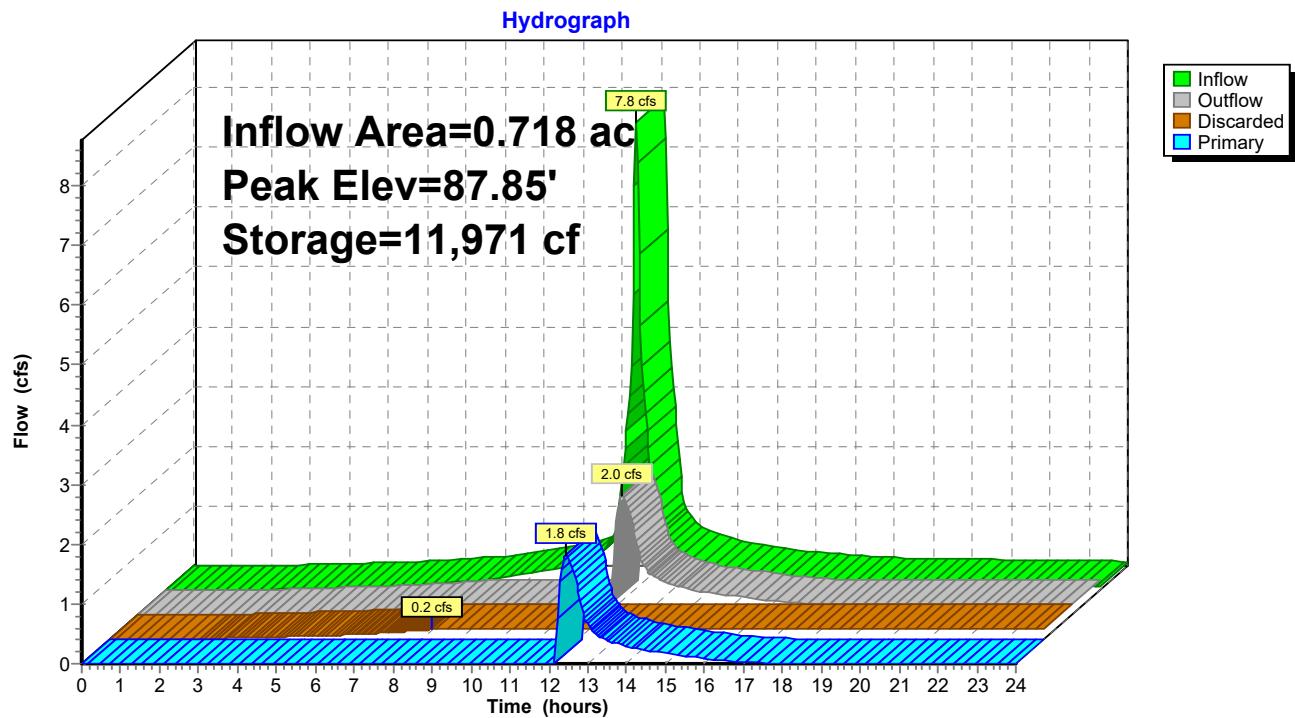
Overall System Size = 35.64' x 83.00' x 6.75'

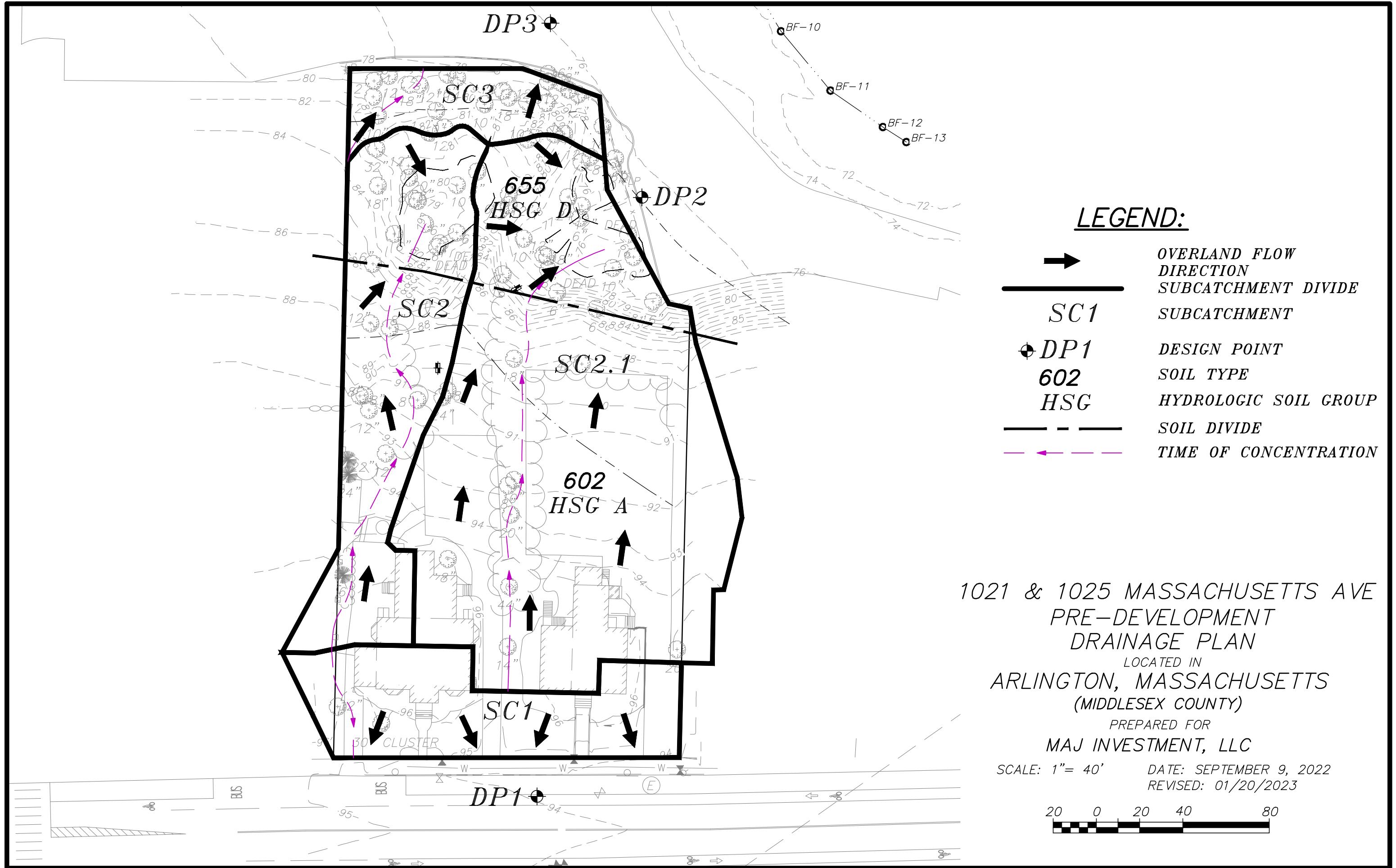
63 Chambers

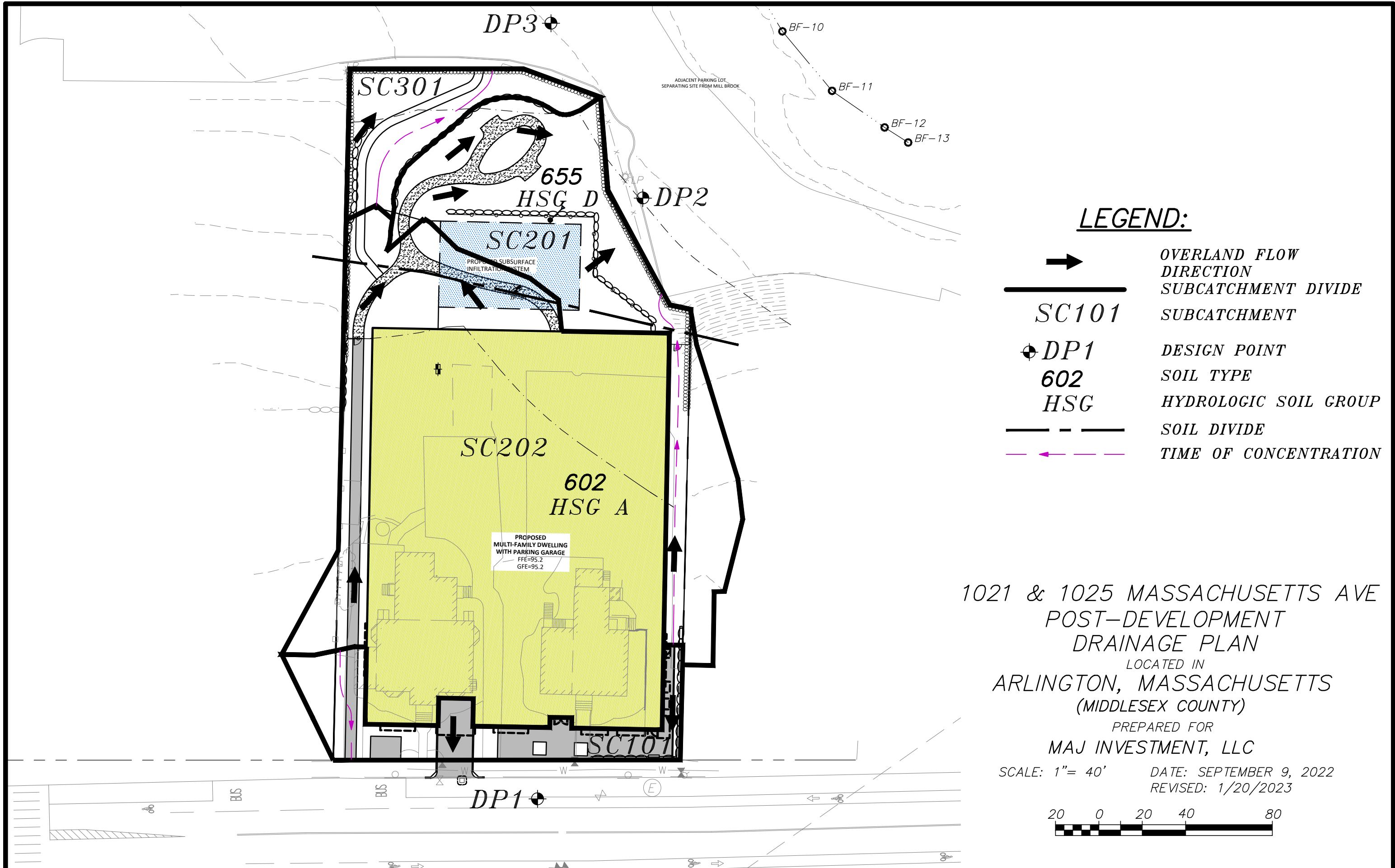
739.6 cy Field

464.8 cy Stone



**Pond PSIS: PSIS**



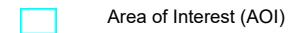


## Soil Map—Middlesex County, Massachusetts (1021-1025 Massachusetts Ave, Arlington Ma)



## MAP LEGEND

### Area of Interest (AOI)



Area of Interest (AOI)

### Soils



Soil Map Unit Polygons



Soil Map Unit Lines



Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



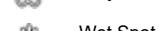
Spoil Area



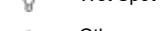
Stony Spot



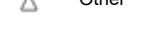
Very Stony Spot



Wet Spot

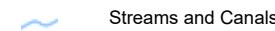


Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts

Survey Area Data: Version 21, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	3.4	72.4%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.3	6.8%
655	Udorthents, wet substratum	1.0	20.8%
<b>Totals for Area of Interest</b>		<b>4.7</b>	<b>100.0%</b>

## INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calcualtions must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

# TSS Removal Calculation

**Location:** 1021 & 1025 Massachusetts Avenue, Arlington MA

**Train 1:** PSIS

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Proposed Subsurface Infiltration System (PSIS)	80%	1.00	0.80	0.20

**Total TSS Removal =**

80.0%

**Project:** 21583  
**Prepared By:** Patriot Engineering  
**Date:** 1/20/2023

\*Equals remaining load from previous BMP(E)  
which enters the BMP

\*\* See portion of STEP Fact Sheet for removal rate

## CAPTURE AREA ADJUSTMENT

Due to a limitation of grading adjustments that can be made for this project the amount of runoff that can be directed to the infiltration facility. Therefor the storage capacity of the infiltration facilities has been increased to allow for so it may capture more of the runoff from the impervious surface within the drainage area.

The following calculation in accordance with MA Stormwater Handbook demonstrates at the storage capacity of the infiltration BMP's is sufficient to meet Standard #3.

Steps:

1. Required recharge volume for total site impervious area.

From Standard #3 recharge calculations page, summation of required recharge volume = 1,388 CF

2. Site impervious area draining to recharge facilities (from previous).

Area = 27,765 SF

3. Divide total site impervious area by impervious area draining to recharge facilities. Roof runoff captured completely within infiltration systems on each lot.

Total Site Impervious = 27,765 SF

27,748 SF / 25,522 SF = 1.09

4. Multiply result of #3 by original recharge volume in #1.

1.09 x 1,388 = 1,509 CF

5. Ensure minimum 65% impervious area draining to recharge facilities.

25,552 SF / 27,765 SF = 0.92 = 92%

6. Recharge facilities provide total recharge volume of 10,498 CF (below to outlet). Recharge volume 10,498 CF > 1,509 CF adjusted total recharge volume.

All Recharge Volumes have been achieved as required by the Massachusetts Stormwater Management Standards

## 72-HOUR DRAW DOWN CALCULATIONS

$$\text{Time} = \frac{R_v}{(K)(\text{BottomArea})(n)}$$

$R_v$  = Storage Volume

$K$  = Saturated Hydraulic Conductivity for Sandy Loam = 1.02 in/hour

Bottom Area = Bottom Area of Recharge Structure

$n$  = Porosity (1)

### PSIS-1

$R_v$  = 12,209 cf

Bottom Area = 2,932 sf

$$\text{Time} = 12,209 \text{ cf} / (2.41 \text{ in/hr})(1'/12'')(2,932 \text{ sf})(1)$$

Time = 20.7 hours

20.7 hours < 72 hours

**OPERATION AND MAINTENANCE &  
EROSION AND SEDIMENTATION CONTROL PROGRAM  
for  
A PROPOSED STORMWATER MANAGEMENT SYSTEM  
located at  
1021 & 1025 MASSACHUSETTS AVENUE  
ARLINGTON, MASSACHUSETTS**

**Applicant:**

1025 Mass Ave., LLC  
13 Wheeling Avenue  
Woburn, Massachusetts 01801

**Prepared by:**

Patriot Engineering  
35 Bedford Street, Suite 4  
Lexington, Massachusetts 02420  
(978) 726-2654

**September 9, 2022  
Revised: 04/14/2023**



**Project Name:** 1021 & 1025 Massachusetts Ave, Arlington Ma

**Owner Name:** The Maggiore Companies

**Party Responsible for Maintenance**

**During Construction:** Contractor

**Party Responsible for Maintenance**

**After Construction:** Homeowner's Association

### **Erosion and Sedimentation Control Measures during Construction Activities**

#### **Filtermitt (or approved equal)**

Filtermitt (or approved equal) will be installed along the down gradient limit of work as depicted on the Site Plan. The filtermitt shall be installed prior to the commencement of any work on-site and in accordance with the design plans. An additional supply of filtermitt shall be on-site to replace and/or repair any filtermitt that have been disturbed or are in poor condition. The line of filtermitt shall be inspected and maintained on a weekly basis and after every major storm event (2-year) during construction. No construction activities are to occur beyond the filtermitt at any time. Deposited sediments shall be removed when the volume of the deposition reaches approximately one-half the height of the filtermitt.

#### **Stockpiles**

All unused debris, soil, and other material shall be stockpiled in locations of relatively flat grades, away from any trees identified to be saved and upgradient of the filtermitt. Stockpile side slopes shall not be greater than 2:1. All stockpiles shall be surrounded by a row of filtermitt. Surrounding filtermitt shall be inspected and maintained on a daily basis.

#### **Surface Stabilization**

The surface of all disturbed areas shall be stabilized during and after construction. Disturbed areas remaining idle for more than 14 days shall be stabilized. Temporary measures shall be taken during construction to prevent erosion and siltation. No construction sediment shall be allowed to enter any infiltration system or formal drainage system. All disturbed slopes will be stabilized with a permanent vegetative cover. Some or all of the following measures will be utilized on this project as conditions may warrant.

- a. Temporary Seeding
- b. Temporary Mulching
- c. Permanent Seeding
- d. Placement of Sod
- e. Hydroseeding
- f. Placement of Hay
- g. Placement of Jute Netting

Dust shall be controlled at the site.

## **Tree Protection**

Existing trees to be saved shall be protected with orange construction fence (offset from the tree trunk by professional standard based on canopy).

## **Construction Tracking Pad**

A construction tracking pad shall be installed at the designated entrances/exits, as shown on the Site plans, to the site to reduce the amount of sediment transported off site. The construction tracking pad shall be inspected weekly.

## **Silt Sacks**

Silt Sacks shall be installed within the basins. The performance of the basins shall be checked after every major storm event during construction, in the event of clogging within the Silt Sack, it shall be removed and replaced with a clean Silt Sack. Stormwater quality unit shall be checked bi-weekly.

## **Subsurface Infiltration Facility**

Construction activity above and around the proposed location of the subsurface infiltration facility shall be limited to prevent compaction of the existing soil. Care shall be taken to redirect stormwater runoff from this area to prevent ponding. Installation of this system shall occur under dry weather conditions and system shall be backfilled immediately to prohibit the introduction of fines or other material that would compromise the functionality of this system.

## **Inspection and Maintenance of Area Drain**

The performance of the area drain shall be checked after every major storm event during construction.

## **Removal of Sediment and Erosion Controls**

At the completion of construction activities and after receiving approval from the Town of Arlington, all physical sediment and erosion controls shall be removed from the site per Town of Arlington. The areas where the controls have been removed shall be seeded and stabilized immediately upon removal.

## **Long-Term Inspection and Maintenance Measures after Construction**

### **Erosion Control**

Eroded sediments can adversely affect the performance of the stormwater management system. Eroding or barren areas should be immediately re-vegetated.

### **Subsurface Infiltration Facility**

The infiltration system inspections should include inspections following the first several rainfall events or first few months after construction, after all major storms (3.2" inches of

rain over a 24-hour period or greater), and on regular bi-annual scheduled dates, to ascertain whether captured runoff drains within 72 hours following the event. Ponded water inside the system (as visible from the observation well) after several dry days often indicates that the bottom of the system is clogged. If the water does not drain, then a qualified professional should be retained to determine the cause of apparent infiltration failure and recommend corrective action. Such corrective action should be immediately implemented by the homeowner. If depth of sediment is observed to be greater than 3" then the system should be cleaned. The homeowner shall contact a sewer and drain cleaning company to flood the system via pump truck so the water is forced back to the upstream cleanout where sediment can be vacuumed out.

### **Inspection and Maintenance of Area Drains**

The area drain shall be inspected quarterly including the end of the foliage and snow removal seasons, and if necessary, any maintenance shall be performed so that it functions as designed. The area drain shall be cleaned bi-annually, or when sediment in the bottom of the sump reaches ½ the depth from the bottom of the invert of the lowest pipe in the basin. Inlet and outlet pipes should be checked for clogging.

### **Debris and Litter Removal**

Trash may collect in the BMP's, potentially causing clogging of the facilities. All debris and litter shall be removed when necessary, and after each storm event. Sediment and debris collected from vacuuming and/or sweeping should be disposed of at a permitted waste disposal facility. Avoid disposing of this material on site, where it could be washed into the proposed subsurface infiltration systems.

### **Lawn Mowing**

All lawn mowing to take place will be done with a mulch mower so grass clippings will not be an issue.

### **Good Housekeeping Practices (in accordance with Standard 10 of the Stormwater Management Handbook to prevent illicit discharges)**

#### **Provisions for storing paints, cleaners, automotive waste and other potentially hazardous household waste products inside or under cover**

- All materials on site will be stored inside in a neat, orderly, manner in their appropriate containers with the original manufacturer's label.
- Only store enough material necessary. Whenever possible, all of a product shall be used up before disposing of container.
- Manufacturer, local, and State recommendations for proper use and disposal shall be followed.

#### **Vehicle washing controls**

- A commercial car wash shall be used when possible. Car washes treat and/or recycle water.
- Cars shall be washed on gravel, grass, or other permeable surfaces to allow filtration to occur.
- Use biodegradable soaps.

- A water hose with a nozzle that automatically turns off when left unattended.

#### **Requirements for routine inspection and maintenance of stormwater BMPs**

- See Inspection and Maintenance Measures after Construction.

#### **Spill prevention and response plans**

- Spill Control Practices shall be in conformance with the guidelines set forth in the National Pollutant Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan (SWPPP)

#### **Provisions for maintenance of lawns, gardens, and other landscaped areas**

- Grass shall not be cut shorter than 2 to 3 inches and mulch clipping should be left on lawn as a natural fertilizer.
- Use low volume water approaches such as drip-type or sprinkler systems. Water plants only when needed to enhance root growth and avoid runoff problems.
- The use of mulch shall be utilized where possible. Mulch helps retain water and prevents erosion.

#### **Requirements for storage and use of fertilizers, herbicides and pesticides**

- Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked into the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
- Do not fertilize before a rainstorm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Pesticides shall be applied on lawns and gardens only when necessary and applied only in the minimum amounts recommended by the manufacturer.

#### **Pet waste management**

- Scoop up and seal pet wastes in a plastic bag. Dispose of properly, in the garbage.

#### **Provisions for solid waste management**

- All solid waste shall be disposed of or recycled in accordance with local town regulations.

#### **Snow disposal and plowing plans relative to Resource Area**

- Snow shall be plowed and stored on gravel, grass, or other permeable surfaces to allow filtration to occur.
- Once snow melts all sand salt and debris shall be extracted from surface and properly disposed of.
- Snow shall not be disposed of in any resource area or waterbody.
- Avoid disposing snow on top of storm drain catchbasins or stormwater drainage swale.

#### **Winter Road Salt and/or Sand use and storage restrictions**

- Sand storage piles should be located outside the 100-year buffer zone and shall be covered at all times. No salt to be stored or used on site.
- Alternative materials, such as sand or gravel, should be used in especially sensitive areas.

**Roadway and Parking Lot sweeping schedule**

- Pavement sweeping shall be conducted at a frequency of not less than once per year.
- Removal of any accumulated sand, grit, and debris from driveway after the snow melts shall be completed shortly after snow melts for the season.

**Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL**

Not Applicable

**Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan**

To be determined by the owner.

**List of Emergency contacts for implementing Long-Term Pollution Prevention Plan**

To be determined by the owner.

**Applicant's Certification**

I certify under penalty of law that I have read, understand and agree to abide by the practices outlined in this document.

Signed:\_\_\_\_\_ Date:\_\_\_\_\_

The Maggiore Companies

**Contractor's Certification**

I certify under penalty of law that I have read, understand and agree to abide by the practices outlined in this document.

Signed:\_\_\_\_\_ Date:\_\_\_\_\_

Contractor

**STORMWATER MANAGEMENT**  
**CONSTRUCTION PHASE**

**INSPECTION SCHEDULE AND EVALUATION CHECKLIST**

**PROJECT LOCATION:** 1021 & 1025 Massachusetts Ave, Arlington MA

**WEATHER:** \_\_\_\_\_

<i>Inspection Date</i>	<i>Inspector</i>	<i>Area Inspected</i>	<i>Required Inspection Frequency if BMP</i>	<i>Comments</i>	<i>Recommendation</i>	<i>Follow-up Inspection Required (yes/no)</i>
		<i>Filtermitt</i>	<i>Weekly and After Major Storm Events</i>			
		<i>Construction Tracking Pad</i>	<i>Weekly and After Major Storm Events</i>			
		<i>Subsurface Infiltration System</i>	<i>Weekly and After Major Storm Events</i>			
		<i>Area Drains</i>	<i>Weekly and After Major Storm Events</i>			

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- (1) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.
- (2) Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval, Construction Sequence and Approved Plan)  
Stormwater Control Manager: \_\_\_\_\_

**STORMWATER MANAGEMENT**  
**AFTER CONSTRUCTION**

**INSPECTION SCHEDULE AND EVALUATION CHECKLIST**

**PROJECT LOCATION:** 1021 & 1025 Massachusetts Ave, Arlington MA

**WEATHER:** \_\_\_\_\_

<i>Inspection Date</i>	<i>Inspector</i>	<i>Area Inspected</i>	<i>Required Inspection Frequency if BMP</i>	<i>Comments</i>	<i>Recommendation</i>	<i>Follow-up Inspection Required (yes/no)</i>
		<i>Subsurface Infiltration System</i>	<i>Bi-annually and After Major Storm Events</i>			
		<i>Area Drains</i>	<i>Quarterly and After Major Storm Events</i>			

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- (3) Refer to the Massachusetts Stormwater Handbook, Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspection and maintenance of specific BMP's.
- (4) Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

Other notes: (Include deviations from: Con. Comm. Order of Conditions, PB Approval, Construction Sequence and Approved Plan)  
Stormwater Control Manager: \_\_\_\_\_